Route 7/20 Corridor
Access Management Plan

Submitted to

Berkshire Regional Planning Commission (BRPC)

Submitted by

Vanasse Hangen Brustlin, Inc.

In association with

MassDOT
BRPC
Town of Lenox
City of Pittsfield

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Acknowledgements

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Executive Summary

This Corridor Access Management Plan has been prepared for the Route 7 and Route 20 roadway between New Lenox Road (in Lenox) and Dan Fox Drive (in Pittsfield). The Route 7/20 corridor is a highly traveled arterial roadway that serves as a major mobility corridor for the Berkshires. The study area includes approximately one-mile of roadway that has a significant number of curb cuts to commercial properties over its length.

One of the goals of this study was to identify areas along the corridor that currently have roadway, access, and pedestrian issues, and assess how these conditions could worsen should traffic increase under future conditions. In addition, the study reviewed existing land use conditions and future development potential. This study also identified areas where vehicle-crashes are significant and a concern. When future development and redevelopment occurs along the corridor and in the region, traffic volumes can be expected to increase. As traffic volumes increase, access to parcels becomes more difficult and there is then the potential for crashes to increase. In addition, the existing two-way-left-turn-lane (TWLTL) would become less effective with higher traffic volumes. The following summarizes the issues that have been identified along the corridor:

- The overall corridor averages 61 access points per mile, which is high based on industry standards for driveway spacing. A high number of access points increases the number of vehicle-conflicts, which increases the likelihood of vehicle-crashes. As a result, there were a total of 109 incidents between February 2007 and February 2010, and two were fatal.

- There are over 1,100 vehicles per hour (vph) that enter/exit the corridor to/from 60 different unsignalized access points during the Saturday midday; during the weekday evening peak hour this total is almost 1,000 vph.

- A significant number of crashes have been observed within the vicinity of West Mountain Road and the Arizona Pizza Company. A total of 12 crashes, including one fatal, have been reported over the three year period. Of the 12 crashes reported, at least 5 were pedestrian-related.

- The existing shoulder width along this section of Route 7/20 is approximately two feet wide, which does not meet current design standards for a principal arterial roadway that is on the National Highway System (NHS).

- Turning left from the driveways between the Center at Lenox and Dan Fox Drive has been observed to be very difficult and unsafe. Approximately 64-percent of all turning movements to/from unsignalized driveways occur between these two intersections.

- Based on gap acceptance data collected at unsignalized driveways along the corridor, it was determined that drivers must act aggressively to exit unsignalized driveways along the corridor. These drivers also use the TWLTL to accelerate and merge onto Route 7/20.

Once the issues were identified, the next goal of this study was to investigate the application of access management techniques to the corridor. Access management controls the location, number, spacing, and design of curb cuts/access points along a major roadway while promoting alternate access to parcels through supporting street systems and interconnecting driveways between parcels. Promoting improved access results in a roadway that operates more safely and efficiently for all users. Access management can be used to organize or minimize these conflicts. An access management matrix was prepared as part of this study to correlate access management techniques to specific concerns that have been identified along the Route 7/20 corridor. This matrix is provided below.

It was determined that successfully applying access management techniques to the Route 7/20 corridor would prove to be challenging given that private parcels and their corresponding infrastructure (parking, signage, utilities, etc.) is located immediately adjacent to the Route 7/20 right-of-way. In addition, applying techniques directly to each parcel would be challenging since most parcels are shallow and the location of existing buildings provides limited opportunities to make adjustments to accommodate these techniques. This study reviews in detail the access management techniques that have also been identified in the table below.

Access Management Matrix

Access Techniques	Access Issues: Limit Turning Movement Conflicts	Separate Turning Movement Conflicts	Auxiliary (Turn) Lanes	Left Turns Exiting a Site	Left Turns Entering a Site	Pedestrian Access/Safety	Bicycle Access/Safety	Roadway Operations	Excessive Driveways	Driveway Operations
Roadway Treatments										
Continuous Two-Way Left-Turn Lane (TWLTL)			X		X			X		
Center Raised Median	X			X	X	X		X	X	X
Shoulder Lane Treatments		X					X	X		
Secondary Roadways										
Frontage/Service Roads	X	X						X	X	
Reverse Frontage Roads	X	X				X		X	X	
Controlled Access										
Traffic Signal Spacing		X		X	X	X	X	X		X
Driveway Design Standards										
Spacing, corner clearances	X	X		X	X	X	X	X	X	X
Joint and Cross Access	X	X		X	X	X	X	X	X	X
Sight Distances		X		X				X		X
Throat Length		X		X	X			X		X
Pedestrian Facilities										
Crosswalk Treatments		X				X	X	X		
New Pedestrian Crossings						X	X	X		
Public Transit										
Bus Stop Location		X				X		X		
Vehicle Guidance										
Restrict Turn Movements	X			X	X	X	X	X		X

Following the review of access management techniques, several of the more relevant infrastructure improvements were considered to improve corridor mobility and accessibility. The following summarizes these improvements:

- <u>*Left-Turn Restrictions:*</u> reviewed peak hour turn restrictions for the TWLTL and at adjacent driveways;

- <u>*Raised Center Median:*</u> reviewed the location of a raised center median that would replace the TWLTL;

- *West Mountain Road Access:* reviewed the realignment of West Mountain Road;
- *Mid-Block Pedestrian Crossing:* reviewed improvement options for the mid-block crossing near West Mountain Road;
- *Signalized Intersection Pedestrian Improvements:* reviewed pedestrian connectivity at signalized intersections;
- *Signalized Intersection Timing and Phasing Adjustments:* reviewed opportunities for enhancing signal operations through timing and phasing adjustments;
- *Driveway Consolidation:* reviewed locations where access could be managed better; and
- *Frontage Roadways:* reviewed the application of either frontage or reverse frontage roads to the corridor for improved corridor access.

Of these improvements, the following two improvements were evaluated in greater detail to determine their level of impact, overall cost and feasibility: (i.) the realignment of West Mountain Road; and (ii.) the construction of a raised median in place of the TWLTL. It was determined that the realignment of West Mountain Road would be more feasible than the raised median. Due to the restricted right-of-way and the location of adjacent land uses, construction of a raised median would be very costly, with significant impacts; thus, not a feasible alternative for the near future.

In addition to transportation improvements, this study examined land use regulations as a means to achieve access management objectives. This study developed consistent zoning bylaw language that would supplement and replace the existing study area zoning in Pittsfield and Lenox. The proposed zoning bylaw would bring consistent regulations to both communities and incorporates access management techniques that would need to be applied for any parcel that: (i.) results in a structural increase of 2,000 square feet or more; (ii.) adds ten or more parking spaces; or (iii.) adds fifty or more new vehicle trips during the peak hour. If a parcel development or redevelopment in either community triggers any of these thresholds, the development of a site plan and traffic impact and access study (TIAS) would be required to be prepared as part of the site plan approval process. More stringent standards would be set in this new bylaw that would focus on access management techniques, including: setbacks, shared parking, driveway design requirements, cross access requirements, drive-through standards, and landscaping standards. This bylaw will allow the Town of Lenox, the City of Pittsfield, and MassDOT to plan for future infrastructure improvements by preserving right-of-way.

This Access Management Plan was prepared to act as a guideline for the BRPC, Town, City, and MassDOT, as well as other stakeholders of the corridor. Judicious application of the results and findings of this plan will help to preserve mobility and improve safety along the Route 7/20 corridor.

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1

Study Process and Framework

This Corridor Access Management Plan for the Route 7 and Route 20 roadway corridor between Lenox and Pittsfield is a joint initiative of the Massachusetts Department of Transportation (MassDOT), the Berkshire Regional Planning Commission (BRPC), the City of Pittsfield and the Town of Lenox. This Chapter presents the study background, study area, study goals/vision, scope, and public participation. Furthermore, a description of access management and the principles used to accomplish safe access are discussed in this chapter.

This study is critically important to the future economic viability and quality of life along the corridor and in the region. This plan reviews existing traffic conditions and land use, and seeks to make improvements that will address future traffic conditions and development opportunities. These improvements are aimed at increasing overall mobility, accessibility and safety for residents, businesses, employees, and visitors while decreasing traffic congestion and its negative impacts on the environment, economy and quality of life.

1.1 Study Background

The Route 7/20 Corridor Access Management Plan began in early 2010. The overarching goal of this effort was to evaluate the Route 7/20 Corridor from a transportation and land use perspective, identify issues, seek public opinions and viewpoints, and develop cohesive transportation and land use recommendations along the corridor.

The study is a partnership between the Massachusetts Department of Transportation (MassDOT) and the Berkshire Regional Planning Commission (BRPC). MassDOT and the BRPC worked closely to acquire federal funding for this Study, and is being funded by the Federal Highway Administration's Transportation Community and Systems Preservation (TCSP) program.

1.1.1 Access Management – An Overview

The goal of access management is to control the location, number, spacing, and design of curb cuts/access points along a major roadway while promoting alternate access to parcels through supporting street systems and interconnecting driveways between parcels. Promoting improved access results in a roadway that operates more safely and efficiently for all users. Poor access management can result in the following consequences:

- An increase in vehicle crashes;
- Collisions involving pedestrians or bicyclists;
- Reduction in roadway efficiency;
- Unsightly commercial strip development;
- Degradation of roadside landscaping;
- Promotion of cut-through traffic on residential streets;
- An increase in commuting times;
- Costly improvements to correct poor access management; and
- Safe access concerns for businesses.

Therefore, it is important to preserve a public roadway through the management of roadway access. The following section reviews principles to promote access management.

1.1.2 Ten Principles of Access Management

It is important to start an access management study by first defining the principles of access management before developing recommendations. Access management can be accomplished by applying the following principles, which have been developed by the Transportation Research Board (TRB):

1. <u>Provide a Specialized Roadway System:</u> design and manage roadways according to the primary functions they serve;

2. <u>Limit Direct Access to Major Roadways:</u> direct property access is more compatible with local and collector roadways;

3. <u>Promote Intersection Hierarchy:</u> a functional classification system is important to promote access from one classification of roadway to another;

4. <u>Locate Signals to Favor Through Movements:</u> poor signal placement may lead to delays and uniform spacing enhances the ability to coordinate traffic signals and ensure continuous movement of traffic;

5. Preserve the Functional Area of Intersections: driveway connections too close to intersections can cause conflicts that impair the function of the intersection;

6. Limit the Number of Conflict Points: limiting the number and type of conflicts between vehicles, vehicles and pedestrians, and vehicles and bicyclists will reduce the likelihood that drivers will make mistakes and have collisions;

7. Separate Conflict Areas: increasing driveway spacing provides drivers with the ability to address one set of potential conflicts before addressing another. As travel speeds increases along a corridor so should the driveway spacing;

8. Remove Turning Vehicles from Through Traffic Lanes: accommodate left-turns to the extent possible;

9. Use Raised Medians to Manage Left-Turn Movements: minimize left turns;

10. Provide a Supporting Street and Circulation System: well-planned, interconnected development is desirable; commercial strip development with separate driveways to each use is not desired;

Promoting access management techniques can benefit the motorists, cyclists, pedestrians, transit riders, businesses, government agencies and communities.

The following sections review access management in the Berkshires and define the need for access management techniques to be applied to this Study Area corridor.

1.1.3 Access Management in the Berkshires

The BRPC has been aware that the operation of a transportation corridor has a great impact on the quality of life of the Berkshires. In 2002, the BRPC created Access Management Guidelines[1] for municipalities, businesses and other users to help prevent and/or reduce unnecessary traffic congestion and safety problems along roadway corridors that resulted from inappropriate redevelopment or development, improper site design, and poor transportation planning and design. A general tool box of access management techniques were presented as part of this effort, with specific examples of poor access management in areas along the Route 7/20 corridor and Route 2 in North Adams.

[1] *Berkshire Access Management Guidelines*, 2nd Edition, Prepared by Fuss & O'Neill, Inc., August 2002.

Since the Route 7/20 corridor serves as the major north-south roadway for the region, connecting the Massachusetts Turnpike to several communities in the north, the Route 7/20 Corridor Access Management Study initiative was developed to resolve the Study Area's existing/future traffic concerns and develop a plan so that future redevelopment doesn't further impact regional mobility.

1.1.4 A Need for Access Management

While traffic volumes in the region have somewhat remained unchanged over the last five years, and in fact may have actually declined over the last two years which may be due to the economy, the corridor has a significant number of curb cuts that generate a significant amount of traffic. The number of curb cuts along the corridor has the potential to contribute to vehicle- and pedestrian-related crashes. With the potential for future redevelopment and traffic growth along the corridor, access can be expected to worsen, and therefore a specific access management plan is needed for this corridor to plan for the future.

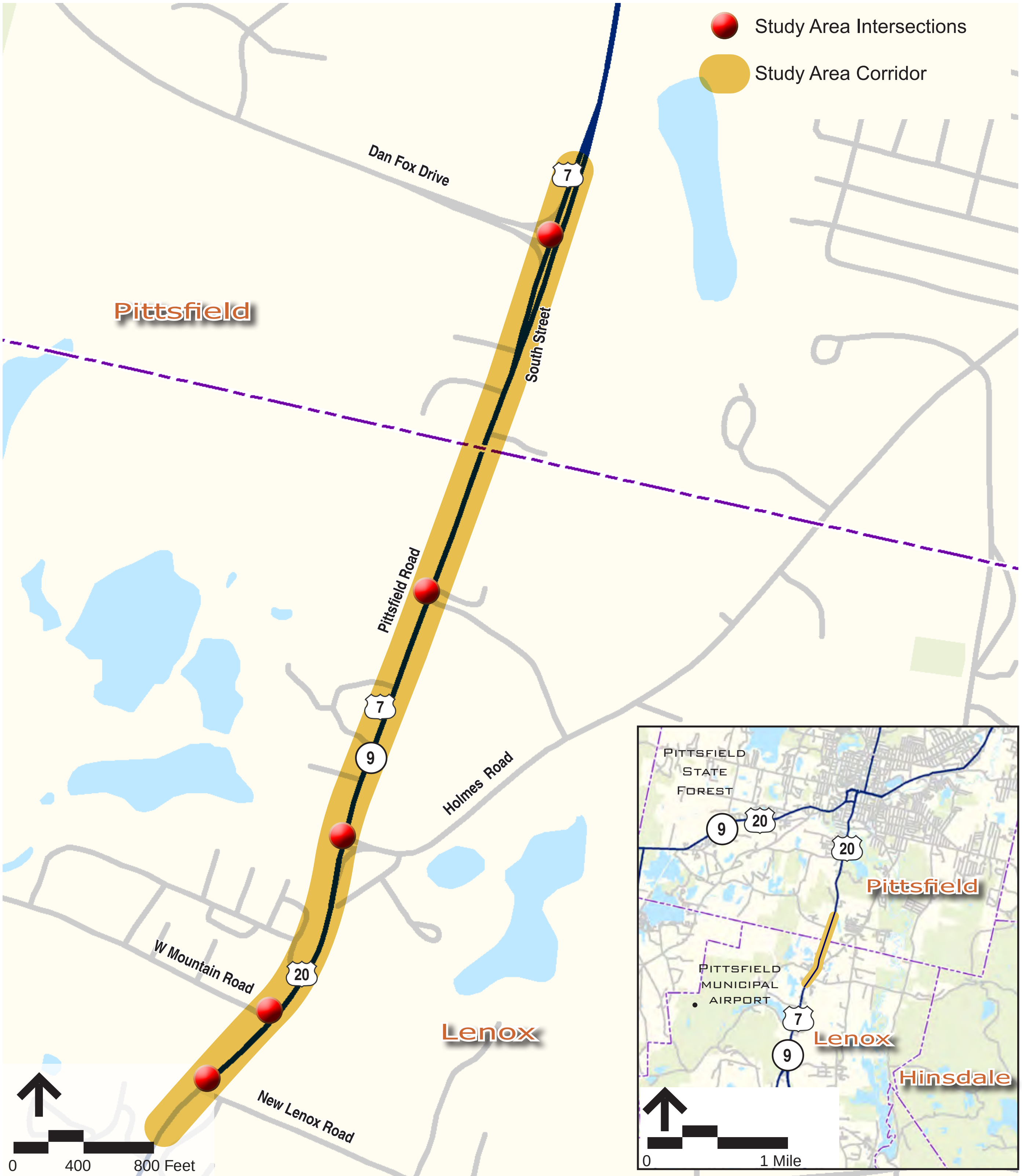
1.2 Study Area

The following section provides an overview of the Study Area intersections and roadways. Figure 1-1 illustrates the Study Area.

1.2.1 Roadways

Route 7 and Route 20 merge in Lenox to form the Route 7/20 corridor, which runs for approximately 7.5 miles between Lenox and Pittsfield. Route 7 is the principal north-south arterial in the region, running between Connecticut and Vermont. On a local level, Route 7 provides access between the Massachusetts Turnpike (Interstate 90) in Lee and Downtown Pittsfield, with Pittsfield being the largest city in Berkshire County. Route 20 is one of the principal east-west arterials in the region and provides the most direct connection between Pittsfield and Albany, NY, which is approximately 30-miles to the west. To the east, Route 20 provides an alternative route to the City of Springfield and continues on to its terminus in Boston.

Within the study area, Route 7/20 varies between a 4-lane and 5-lane cross-section with designated turning lanes at intersections and a two-way left-turn lane (TWLTL) between Holmes Road and Dan Fox Drive. The corridor is under the jurisdiction of MassDOT.



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Study Area Map

Figure 1-1

Route 7/20 Corridor
Access Management Plan

The functional classification of the corridor is *Principal Arterial* and is on the National Highway System (NHS), which means that the roadway is eligible for federal-aid funding since it plays an important role to the regions mobility. The NHS was developed by the Department of Transportation (DOT) in cooperation with the states, local officials, and Metropolitan Planning Organizations (MPOs).

1.2.2 Intersections

The defined study area includes a one-mile corridor of Route 7/20 between Dan Fox Drive and New Lenox Road in the Town of Lenox and City of Pittsfield, Massachusetts. The corridor includes the following key intersections:

1. New Lenox Road (signalized intersection);
2. West Mountain Road (unsignalized intersection);
3. Holmes Road (signalized intersection);
4. Center at Lenox Shopping Plaza/Holmeswood Terrace (signalized intersection); and
5. Dan Fox Drive (signalized intersection).

In addition to these five study area intersections, approximately 50 driveways along the corridor were counted and reviewed as part of this study.

1.2.3 Land Use

Land use along the Route 7/20 study area corridor is primarily a mix of commercial, retail, and hotel uses, with some residential and industrial uses. The density of development varies along the corridor, with less development to the south and then steadily increasing as the corridor approaches the Pittsfield City Line. The mile long stretch of the corridor within the study area is the most heavily developed portion of the corridor, comprising the main retail/commercial corridor south of Pittsfield. Within the study area there is a limited amount of residential use, primarily within the intersections of New Lenox Road and West Mountain Road. Both New Lenox Road and Holmes Road are primarily residential roadways, with farm use and interspersed commercial uses. Land use along Dan Fox Drive is primarily commercial and industrial with some residential use. The Pittsfield Municipal Airport is located off Tamarack Road, which is an extension of Dan Fox Drive.

1.3 Study Vision and Goals

This Corridor Access Management Plan presents a balanced, comprehensive transportation improvement plan for the Route 7/20 Corridor. The plan addresses existing and future (10-year horizon) transportation deficiencies, and incorporates the potential for future development along the corridor. The plan will identify transportation infrastructure needs and identify several improvement opportunities that should be considered for the corridor.

This study is critically important to the future economic viability and quality of life along the corridor and in the region. This plan reviews existing traffic conditions and land use needs and seeks to make improvements that will address future traffic conditions and development/redevelopment opportunities. These improvements are aimed at increasing overall mobility, accessibility and safety for residents, businesses, employees, and visitors while decreasing traffic congestion and its negative impacts on the environment, economy and quality of life.

To guide the development of this plan, the following goals were established:

1. <u>Assessment of Land Use:</u> to provide an analysis of existing and potential interrelationships between transportation facilities, services and land-use.
2. <u>Operational Characteristics:</u> to determine existing and future operational characteristics and deficiencies of the transportation system.
3. <u>Access Management Techniques:</u> to establish a framework for implementing access management techniques between the Town of Lenox, City of Pittsfield, and MassDOT.
4. <u>Future Development:</u> to provide recommendations to accommodate existing and future development without creating unsafe or unduly congested traffic conditions or other adverse community or environmental impacts.
5. <u>Future Recommendations:</u> to formulate recommendations that are compatible with and help preserve the capacity of future transportation improvements.
6. <u>Public Participation:</u> to develop, through an open, public planning process, recommendations to accommodate travel demands associated with anticipated future development while enhancing environmental quality, traveler safety, and other important quality of life aspects, where possible.

1.4 Study Scope

A comprehensive corridor access plan requires a well-defined structure and process. The Route 7 /20 Corridor Access Management Plan is comprised of two distinct phases of work and corridor development and planning:

- **PHASE 1 – Corridor Access Management Plan Development**, including data collection, evaluation of deficiencies/needs, land use review (existing and future), identification of redevelopment standards, and development of the access management plan; and

- **PHASE 2 –Design Element,** including conceptual design development, revisions to current zoning bylaws, and/or preliminary engineering design for specific roadway improvements.

Public participation is integral to both phases of the study. The Public Participation Plan establishes a process that will help achieve project consensus and facilitate community visioning. The public meetings under Phases 1 and 2 will provide a forum for discussion and coordination with residents, businesses, and others interested access management planning along Route 7/20.

The Plan includes the identification of project goals, objectives, and key issues and opportunities that will need to be vetted with the public and Study Management Committee. The Study Management Committee was established to provide oversight and technical guidance and includes representatives from MassDOT, BRPC, the Town of Lenox, and the City of Pittsfield.

1.5 Public Participation Work Plan

The Public Participation Work Plan provides a framework for undertaking a comprehensive outreach process for the Route 7/20 Corridor Access Management Plan. It includes the process to seek consensus and facilitate community visioning through the public workshops and Study Management Committee meetings.

The purpose of the Study Management Committee was to vet and validate goals, objectives, assumptions, and study products. In addition, committee meetings were used to develop a list of criteria and performance goals used when evaluating alternatives.

Two public outreach meetings took place during the study process. Each meeting was organized around a theme. The themes for the public workshops followed the progression of the study and focused on the following:

- Overview and Discussion of Issues and Opportunities;
- Review of Transportation Improvement Alternatives; and
- Presentation of Recommendations.

Comments received from the public during outreach meetings are included in the Appendix.

In addition to the Study Management Committee and Public Outreach Meetings, interviews with key stakeholders were conducted in an effort to gather additional insight and input into the study. Key stakeholders interviewed as part of the study include:

- Municipal planners/engineers;
- Municipal police chiefs or traffic/safety officers;
- Berkshire County Chamber of Commerce;
- Elected officials; and
- Major employers/businesses.

Table 1-1 summarizes the overall study outreach program.

Table 1-1
Study Outreach and Meeting Program

Event	Date	Topic
Study Management Committee Kick-off Meeting	January 21, 2010	Kick-off meeting tasks, schedule, and data needs
Study Management Committee, Meeting #1	March 10, 2010	Review of existing conditions and data collection
Public Outreach, Meeting #1	March 24, 2010	Review of project study vision, goals and existing conditions
Study Management Committee, Meeting #2	April 7, 2010	Review of future conditions and future land uses
Study Management Committee, Meeting #3	May 5, 2010	Review of potential future improvements
Study Management Committee, Meeting #4	June 14, 2010	Review of Phase 2 and design elements of action plan
Town, City, BRPC, Meeting #5	August 30, 2010	Review of Access Management Corridor Overlay District
Study Management Committee, Meeting #6	November 2, 2010	Review of draft study and public outreach presentation
Public Outreach Meeting #2	November 30, 2010	Review of future conditions, issues and opportunities
Town, City, BRPC, Meeting #7	November 30, 2010	Review of proposed Corridor Zoning Bylaw in a joint Municipal Board Meeting

2

Existing Traffic Conditions

This Chapter provides an assessment of the existing traffic conditions along the Route 7/20 Corridor. Sections included in this Chapter present an evaluation of the transportation infrastructure (including demands, safety, and traffic operations), a review of previous studies for the corridor, and an overview of environmental resources. This information will set the framework for a future traffic assessment that is presented in Chapter 5, and the development of an Access Management Action Plan presented in Chapter 6. Key findings from this chapter include:

- Route 7/20 is classified by MassDOT as a *Principal Arterial* and is part of the National Highway System (NHS).

- Within the study area, there is an average of 61 access points per mile along the Corridor.

- There are no designated bicycle facilities within the study area. Within the study area, 2-foot shoulders are provided forcing bicyclists to share the roadway with other vehicles.

- Route 7/20, within the study area, carries between 21,900 and 23,900 vpd on a weekday, and 17,500 and 21,400 vpd on a Saturday. Daily volumes were observed in March and August of 2008, and November of 2009.

- There are over 1,100 vehicles per hour that enter and exit the corridor via 53 unsignalized driveways. This does not include signalized intersections.

- Between February 2007 and February 2010 there were a total of 109 crashes within the study area, of which two resulted in fatalities.

- All signalized intersections within the study area currently operate at Level of Service (LOS) "B" or better.

2.1 Existing Transportation Infrastructure

This section includes an evaluation of the physical conditions of the Study Area Corridor. This information is intended to both identify current roadway design issues and identify improvements that will be considered during the preparation of the action plan in Chapter 6.

Engineering field visits were conducted to document the following:

- Roadway infrastructure and geometric conditions;
- Number access points along the corridor;
- Available right-of-way;
- Maintenance issues;
- Public transportation; and
- Pedestrian and bicycle accommodations.

2.1.1 Study Area Roadways and Intersections

As mentioned in Chapter 1, the defined study area includes approximately one mile of the Route 7/20 corridor between Dan Fox Drive and New Lenox Road. The corridor falls within the limits of the Town of Lenox (Pittsfield Road) and City of Pittsfield (South Street) and is under the jurisdiction of MassDOT. The following key intersections are described in more depth in this section:

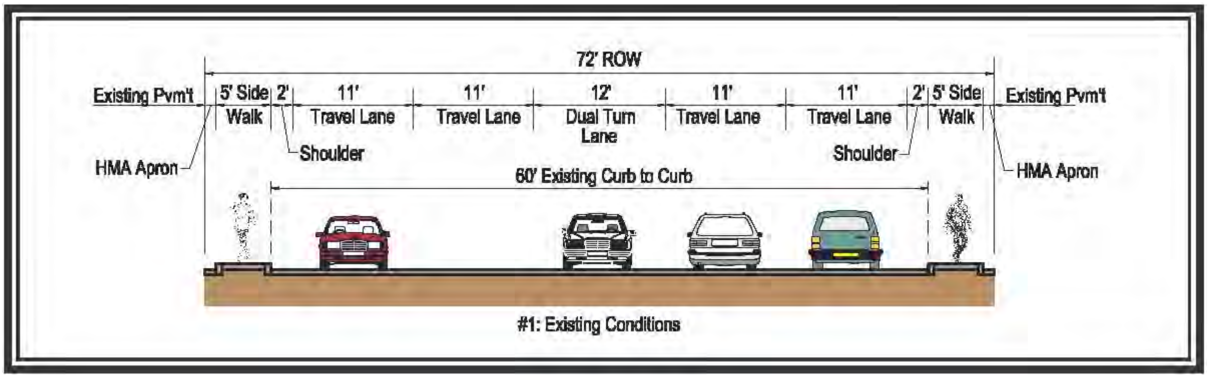
1. New Lenox Road (signalized intersection);
2. West Mountain Road (unsignalized intersection);
3. Holmes Road (signalized intersection);
4. Center at Lenox Shopping Plaza/Holmeswood Terrace (signalized intersection); and
5. Dan Fox Drive (signalized intersection).

Study Area Roadways

Route 7/20

Route 7/20 is the principal north-south arterial in the region and is under the control of the Massachusetts Department of Transportation (MassDOT). Route 7/20 is also known as Pittsfield Road (in Lenox) and South Street (in Pittsfield) and it is on the National Highway System (NHS). Within the study area, Route 7/20 is primarily a 5-lane roadway, with two 11-foot lanes in both the northbound and southbound direction and a 12-foot two-way left turn lane (TWLTL). There are designated turning lanes at intersections with the TWLTL between intersections. Two-foot shoulders are provided throughout the corridor. Figure 2-1 illustrates the cross section for the corridor. To the north of the study area Route 7/20 becomes a 2-lane roadway. Sidewalks are provided on both sides of Route 7/20 between New Lenox Road and Dan Fox Drive; however there is only one signalized crossing, located at the Center at Lenox intersection. There are no bicycle accommodations along the corridor, and there are only two foot striped shoulders on both sides of the roadway. The posted speed limit along Route 7/20 within the study area is 40 miles per hour (mph). Route 7/20 serves as the primary retail corridor south of Pittsfield.

Figure 2-1: Existing Roadway Cross-Section



New Lenox Road

New Lenox Road is a two-lane local roadway, maintained by the Town of Lenox, which provides access to Route 7/20 for several residential streets to the east of the Study Area. New Lenox Road also provides indirect access, via East Lenox Road, to Downtown Pittsfield to the north and Route 8 to the east. The speed limit on New Lenox Road is 35 mph. There are no sidewalks on New Lenox Road and the land use is predominantly residential.

West Mountain Road

West Mountain Road is a 2-lane local roadway, maintained by the Town of Lenox. West Mountain Road runs between Route 7/20 to the north and Reservoir Road to the south, which continues into Lenox Center to the south and the Town of Richmond to the west. There are no pavement markings or sidewalks. West Mountain Road also provides an indirect access to the Berkshire Mobile Home Park, which has a driveway access to Route 7/20 just to the north of this intersection.

Holmes Road

Holmes Road is a locally controlled minor arterial roadway that provides access between Route 7/20 and a large residential area located just southeast of Downtown Pittsfield. Holmes Road also serves as a commuter route for residents of Pittsfield, and can also serve as a bypass (or cut-through) of Downtown Pittsfield, allowing residents and commuters to avoid the series of traffic signals along South Street (Route 7/20). The speed limit on Holmes Road is 35 mph. There are no sidewalks on Holmes Road and the land use is predominantly residential although there are some commercial and institutional uses.

Dan Fox Drive

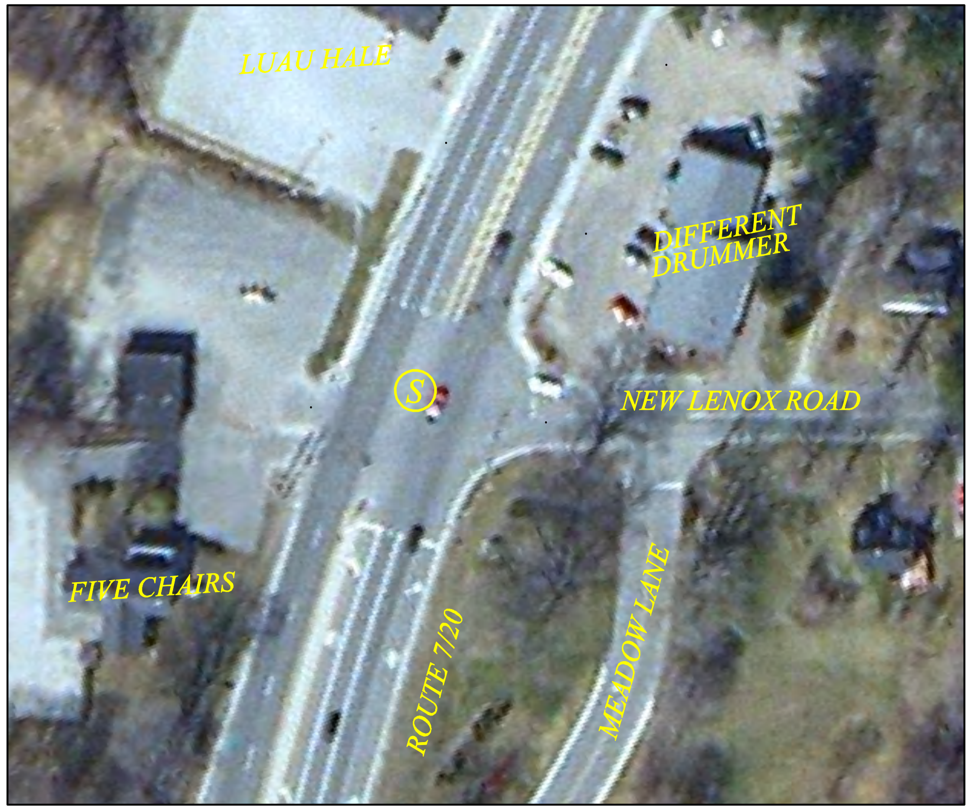
Dan Fox Drive is a two-lane minor arterial that is under the control of MassDOT. Dan Fox Drive, via Tamarack Road, provides access between Route 7/20 and the Pittsfield Municipal Airport, which lays approximately 2-miles to the west of the study area. Dan Fox Drive also provides access to Bousquet Ski Mountain. Land use along this roadway primarily consists of commercial, retail or industrial type uses, although there is a relatively new housing complex that is currently under construction at Bousquet Ski Mountain. There are no sidewalks on Dan Fox Drive.

Study Area Intersections

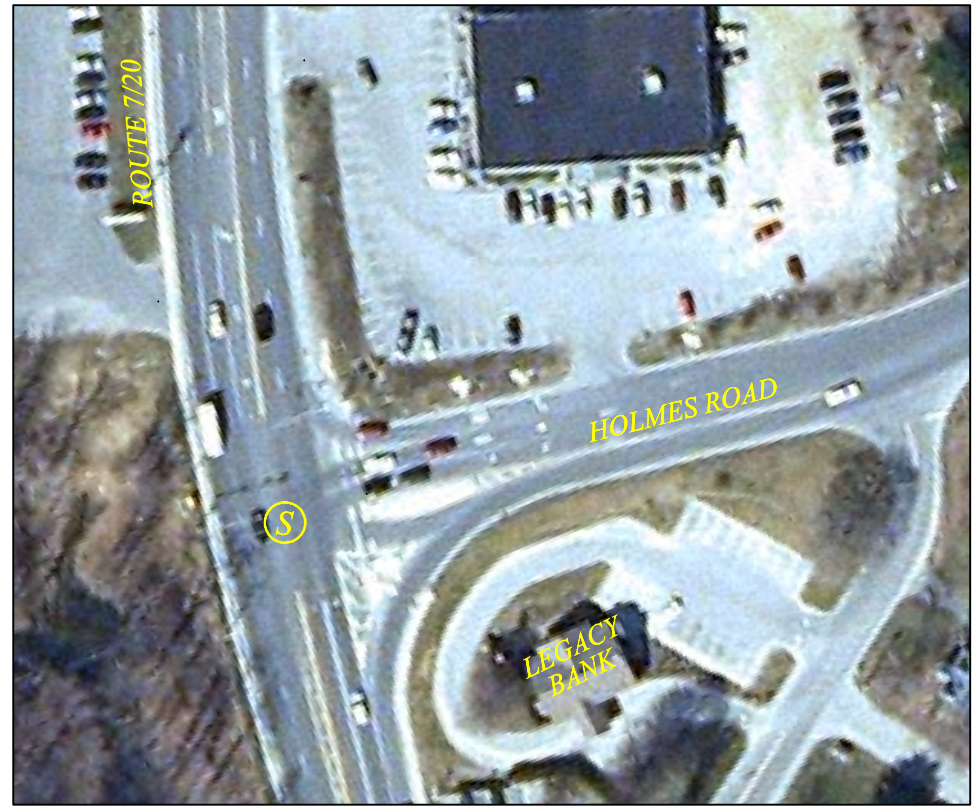
Aerial views of the study area intersections are provided in Figure 2-2.

Route 7/20 & New Lenox Road

Route 7/20 and New Lenox Road intersect to form a fully actuated signalized intersection. A commercial driveway opposite New Lenox Road forms the fourth leg of the intersection. The northbound Route 7/20 approach provides designated left- and right-turn lanes and two through lanes, while the southbound approach provides a designated left-turn lane, a through lane and a shared through/right-turn lane. The New Lenox Road and the commercial driveway approach both consist of a single lane. The traffic signal operates as a 3-phase actuated signal with protected phase for the southbound left-turn. No crosswalks are provided at this intersection. There are no sidewalks on New Lenox Road or south of the intersection on Route 7/20.



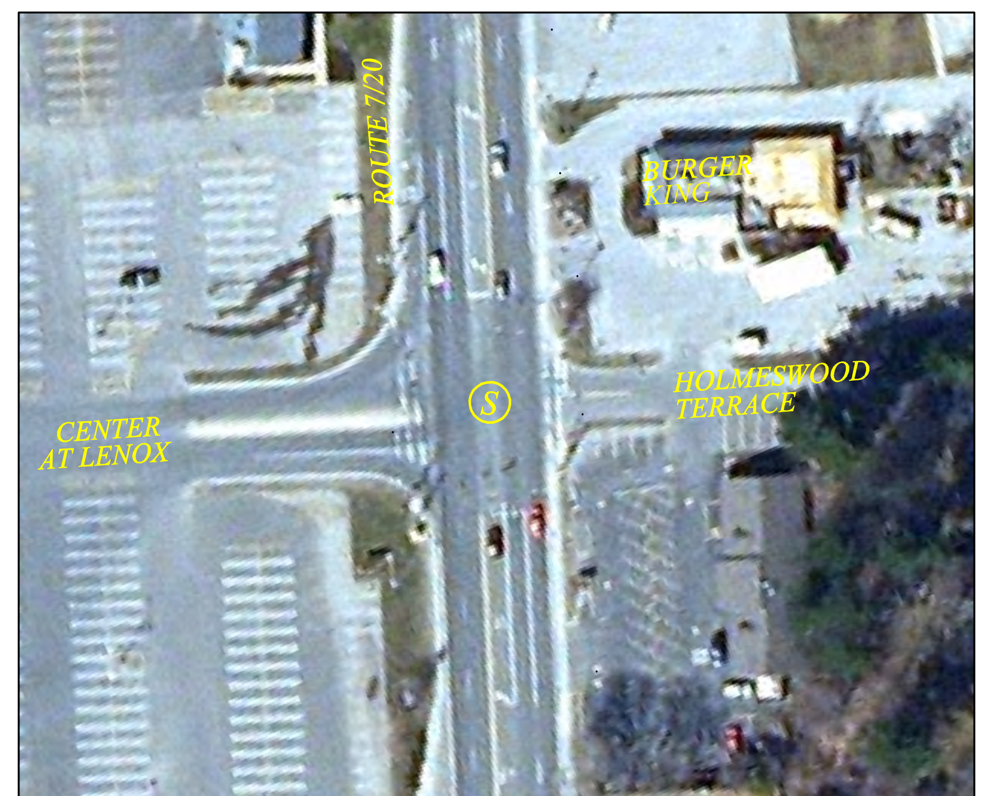
ROUTE 7 & 20 AT NEW LENOX ROAD



ROUTE 7 & 20 AT HOLMES ROAD

ROUTE 7 & 20 AT DAN FOX DRIVE

ROUTE 7 & 20 AT WEST MOUNTAIN ROAD



ROUTE 7 & 20 AT CENTER AT LENOX

0 50 100 Feet

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Figure 2-2

Study Area Intersections
Aerial View
Route 7/20 Corridor
Access Management Plan

Route 7/20 & West Mountain Road

Route 7/20 and West Mountain Road form a three-way unsignalized intersection, with West Mountain Road under stop-sign control. A designated left-turn lane is provided on the Route 7/20 northbound approach. The West Mountain Road approach consists of a single all-purpose lane. There is a crosswalk across West Mountain Road. A crosswalk exists across Route 7/20, but approximately 160 feet to the north of this intersection.

Route 7/20 & Holmes Road

Route 7/20 and Holmes Road intersect to form a fully actuated signalized three-way intersection. The northbound Route 7/20 approach consists of two through lanes and a channelized right-turn lane, while the southbound approach provides a designated left-turn lane and two through lanes. The Holmes Road approach consists of three lanes; two left-turn lanes and a right-turn lane. The traffic signal operates as a 3-phase actuated signal with a protected southbound left-turn phase and overlapping westbound right-turn phase. There is an unsignalized crosswalk across Holmes Road, but no crossing of Route 7/20.

Route 7/20 & Center at Lenox/ Holmeswood Terrace

Route 7/20, Holmeswood Terrace and the driveway to the Center at Lenox form a fully actuated signalized four-way intersection. The northbound Route 7/20 approach consists of a designated left-turn lane, a through lane and a shared through/right-turn lane, while the southbound approach consists of a designated left-turn lane, two through lanes and a designated right-turn lane. The Holmeswood Terrace approach consists of single all-purpose lane. The Center at Lenox approach consists of a shared left-turn/through lane and a designated right-turn lane. The traffic signal operates as a 4-phase actuated signal. Left-turns from Route 7/20 operate with lead-lag protected-permissive phasing, while Holmeswood Terrace and the Center at Lenox approaches run concurrently. The Center at Lenox designated right-turn lane is provided an overlapping phase with the northbound left-turn phase. An exclusive pedestrian phase is provided via push-button actuation for pedestrians crossing Route 7/20, with a crosswalk located on the south side of the intersection. Unsignalized crosswalks are provided across both Holmeswood Terrace and the Center at Lenox driveway.

Route 7/20 & Dan Fox Drive

Route 7/20 and Dan Fox Drive form a fully actuated signalized three-way intersection. The northbound Route 7/20 approach consists of a designated left-turn lane and two through lanes, while the southbound approach consists of a two through lanes and a channelized right-turn lane. The Dan Fox Drive approach consists of single left-turn lane and a channelized right-turn lane. The traffic signal operates as a 3-phase actuated signal, with northbound left-turns operating with protected phasing, with an overlapping eastbound right-turn phase. There are no sidewalks at this intersection.

2.1.2 Access Points

As noted in Chapter 1, Route 7/20 from New Lenox Road to Dan Fox Drive is designated as a *Principal Arterial*, which means that it is intended to support regional mobility and that access points should be limited to the extent possible. Since the roadway is under the jurisdiction of MassDOT, an access permit is required for any modification to an existing driveway or addition of a new driveway. The following identifies characteristics of a Principal Arterial:

- Principal Arterials typically carry between 15,000 vpd and 50,000 vpd;
- Direct access to parcels should be restricted or denied;
- The primary function of a Principal Arterial is usually to serve through traffic;
- Principal Arterials access is typically at intersections only; and
- Access at other non-intersections (driveways) are typically restricted to right and left-turns in, and right-turns out.

As part of this study, existing driveways (residential, commercial, or retail), and roadway intersections, were identified. These curb cuts are illustrated in Figures 2-3 and 2-4. The following provides an overview of the existing driveway characteristics along the corridor; this information is also summarized in Table 2-1 below.

- A total of 60 access points were identified along the study area corridor;
- The overall corridor averages 61 access points per mile;
- Approximately 85-percent of these access points are driveways used by retail or commercial uses;
- Approximately 56-percent of the access points are on the easterly side of the roadway;
- The section of the corridor that has the highest density of access points is between the Center at Lenox and Dan Fox Drive (a total of 30 access points exist for a density of approximately 73 access points per mile;
- The section of the corridor with the fewest access points is between Holmes Road and Center at Lenox (a total of 14 access points exist for a driveway density of almost 52).

- There are over 1,100 vehicles per hour that enter and exit the corridor via 53 unsignalized driveways. This does not include signalized intersections.

Table 2-1
Existing Access Points

Driveway Type	Direction / Distance	New Lenox Road to Holmes Road 0.30 miles	Holmes Road to Center at Lenox 0.27 miles	Center at Lenox to Dan Fox Dr 0.41 miles[4]	Total 0.98 miles
Non-Residential[1]	Eastside[2]	6	8	15	29
	Westside[2]	5	5	13	23
Residential	Eastside	2	0	0	2
	Westside	1	0	0	1
Roadway Intersections[3]	Eastside	1	0	1	2
	Westside	1	1	1	3
Total Number of Access Points	Eastside	9	8	16	33
	Westside	7	6	14	27
	Total	16	14	30	60
Access Density (per mile)	Eastside	30.0	29.6	39.0	33.7
	Westside	23.3	22.2	34.1	27.5
	Total	53.3	51.8	73.1	61.2
Curb Cut Traffic Volume Summary[5]	Lowest Volume	2 / 0	0 / 1	0 / 1	0 / 0
(Weekday evening / Saturday Midday)	Highest Volume	65 / 56	46 / 70	90 / 118	90 / 118
	Average	19 / 19	12 / 17	30 / 34	23 / 26
	All Movements (total)	241 / 248	111 / 150	632 / 723	984 / 1,121

Source: Based on field observation data collected by Vanasse Hangen Brustlin in February 2010, and by Innovative Data, LLC. (for VHB) in March 2010.
1. Non-residential driveways include commercial, retail and industrial land uses
2. All driveways on the east or west sides of Route 7/20.
3. Roadway intersections include any roadway (unsignalized or signalized) that intersects this Route 7/20 corridor. Driveways to retail developments, and at signalized intersections, are counted under the non-residential category described above.
4. The access density for this area increases to 86 per mile when the signalized intersection of Dan Fox Drive is not included; meaning that the limits of this area are reduced to 0.35 miles which does not include the median and area where turn lanes are present.
5. Volumes shown are for the peak one hour periods during the weekday evening and Saturday midday. Volumes indicated are the total amount of traffic entering and exiting the corridor from an unsignalized intersection or driveway. Signalized intersection volumes have been excluded from this summary.

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Source: Mass GIS, Berkshire County, Town of Lenox, City of Pittsfield
Curb Cut volumes collected by VHB in March 2010
Crash data provided by Town of Lenox and City of Pittsfield

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Figure 2-3

Curb-Cut Volumes & Crash Locations

Route 7/20 Corridor
Access Management Plan

\\Maworc\projects\11140.00\GIS\project\RT7_20-accidents and curbcuts-11x17_North.mxd

Source: Mass GIS, Berkshire County, Town of Lenox, City of Pittsfield
Curb Cut volumes collected by VHB in March 2010
Crash data provided by Town of Lenox and City of Pittsfield

Feet
0 50 100 200

Curb Cut Volumes
- < 10
- 11 - 30
- 31 - 60
- 61 - 90
- 91 >

Crashes Year
- 2007
- 2008
- 2009

Bus Stop
Parcel

Vanasse Hangen Brustlin, Inc.

Curb-Cut Volumes & Crash Locations

Figure 2-4

Route 7/20 Corridor Access Management Plan

2.1.3 Infrastructure Improvement History

In order to provide an accurate representation of existing (and future) traffic volumes along the corridor, relevant data and analyses were obtained from reports prepared by state, regional, local entities, and private organizations. The following provides a summary of the reports reviewed as part of this process:

- Safety Operational Study Pittsfield – Lenox Road – 1975 (Vorhees and Associates): This study proposed safety improvements at the intersection of New Lenox Road including the widening of Route 7/20 from West Mountain Road through the intersection of New Lenox Road to accommodate additional travel lanes. Widening was proposed on the westerly side of the roadway.

  Product: Resulted in intersection improvements/right-of-way expansion at intersection of Route 7/20 and New Lenox Road in 1980.

- Route 7/20 Corridor Planning Study: Problem Identification – May 1989 (BRPC): This study reviews and presents the results of the problems related to the transportation conflicts as a result of land use along Route 7/20. The study also identifies the need for signalization of the Center at Lenox and safety issues of accessing the corridor from driveways.

  Product: Resulted in document, which provided basis for recommendations presented in the Route 7/20 Corridor Planning Study: Alternatives Analysis – June 1989 (BRPC).

- Route 7/20 Corridor Planning Study: Alternatives Analysis – June 1989 (BRPC): This study presents the results of the analysis of alternative solutions related to the transportation conflicts as a result of land use along Route 7/20. More specifically the following was identified in this study: (i.) inconsistent land use policies, (ii.) inadequate roadway capacity, (iii.) conflict of turning movements from driveways, (iv.) conflict between local and state interests, and (v.) conflict of private and public interests.

  Product: Resulted in recommendations for converting Route 7/20 to a four-lane (12-foot lanes/minimal shoulders) roadway with left-turn prohibitions from private driveways.

- Route 7/20 Corridor Evaluation and Planning Study: Short Range Element – December 1989 (MassDOT): This study was initiated after MassDOT reviewed a series of private development proposals that indicated the corridor would deteriorate at an alarming rate if each development were approved and no infrastructure improvements were proposed. More specifically, this study reviewed the impacts of widening the corridor to four lanes (2 in each direction) and installing a raised median that would limit the access along the corridor. The study also recommended access management techniques that would be used when granting access to private developments.

Product: Resulted in Route 7/20 widening project completed in 2000.

- Berkshire Access Management Guidelines, August 2002 (BRPC): In 2002, the BRPC created Access Management Guidelines for municipalities, businesses and other users of the corridor to help prevent and/or reduce unnecessary traffic congestion and safety problems along roadway corridors which result from inappropriate development, improper site design, and poor transportation planning and design. A general tool box of access management techniques were presented as part of this effort, with specific examples of poor access management in areas along this corridor and Route 2 in North Adams.

  Product: Resulted in document to provide direction for local municipalities in dealing with access management concerns as it relates to planning process and future development/construction.

- Lenox Shops/Gateway ENF – May 2005 (EEA # 13540): This study was prepared to summarize the impacts associated with the construction of a residential development. This development would complement the previously constructed 81,300 square feet of retail-commercial use. The project is located on the westerly side of Route 7 approximately 1,500 feet south of West Dugway Road in Lenox. The expansion included a residential component that totaled 63,500 square feet or 51 total housing units. The entire site would include 144,800 square feet.

  Product: Resulted in State and local permitting of proposed development, which was completed in 2007.

- Pittsfield-Lenox Route 7/20 Corridor Access Report – September 2005 (BRPC): This report provided an inventory of the existing curb cuts and overview of the issues and opportunities for driveway access.

  Product: Resulted in action list to be studied further as part of the current project.

- Lane Departure Road Safety Audit for Holmes Road, July 2008: This study conducted a safety audit of Holmes Road. The study reviewed traffic safety challenges (limited sight distance, excessive speeds, lack of pedestrian/bicycle accommodations, etc.) and provided a series of short-term recommendations for improvements. Improvements that were identified include: correcting vertical alignments, clearing of roadside brush, improve signage, enhance roadway edge lines, improve visibility of signal heads for Route 7/20 left-turn movements to Holmes Road, provide signalized pedestrian accommodation at Route 7/20, and implement a raised median on the northbound Route 7/20 approach to restricting turning movements to adjacent retail properties.

  Product: Resulted in recommendations for intersection improvements surrounding Holmes Road to be studied further as part of this project.

- The Center at Lenox Retail Expansion, October 2008 (EEA # 14332): An ENF was filed in October 2008 that proposed the expansion of the Center at Lenox Shopping Plaza. The parcel consists of a total of 35.99 acres and is located on the westerly side of Route 7/20 across from Holmeswood Terrace. The existing site consists of approximately 106,139 square feet of retail uses and approximately 85,969 square feet of additional retail space is proposed. At the time of this study, the project was currently being reviewed by the Town of Lenox.

  Product: Traffic Impact and Access Study used for State and local permitting processes for proposed retail development.

2.1.4 Maintenance Issues

MassDOT District 1 officials indicated that there are no maintenance issues along this corridor other than accumulating snow during the winter months on the sidewalks, and snow banks at the corners of the intersections/driveways that can sometime obstruct the driver's line of sight when exiting. MassDOT reported no major construction projects planned along this corridor.

2.1.5 Right-of-Way (ROW)

The existing right-of-way (ROW) for this corridor is fairly consistent and is typically between 70 and 80 feet. Points where ROW increases are in areas were bus bays have been installed or where driveway and/or intersections exist. The back of the sidewalk is generally the limit of the ROW. The pavement width is approximately 54 feet to 72 feet, with variations being mostly south of Holmes Road. The pavement width north of Holmes Road is generally consistent and totals approximately 60 feet which consists of two through lanes in each direction along with left-turn lanes or the two way left-turn lane. It should be noted that the existing shoulder width along this section of Route 7/20 is approximately two feet wide, which does not meet current design standards for a principal arterial roadway that is on the National Highway System (NHS). This is a result in the change of design requirements set by MassDOT and the Federal Highway Administration (FHWA) since the construction of the additional through lane along this section of Route 7/20.

Table 2-2 summarizes the approximate ROW for the study area corridor.

Table 2-2
Existing Right-of-Way

City	Roadway Section	Existing Roadway Length	Existing ROW Width (feet)
Lenox	New Lenox Road to Holmes Road	0.31 miles	80'
Lenox	Holmes Road to Center at Lenox	0.28 miles	70' to 80'
Lenox/Pittsfield	Center at Lenox Plaza to Dan Fox Drive	0.44 miles	70'

Source: Information obtained from MassDOT and based on design plans prepared for the 4-lane roadway widening project for study area.

2.1.6 Public Transportation

The Berkshire Regional Transit Authority (BRTA) provides transit service throughout the region including along the Route 7/20 corridor. Service within the study area is limited to a single route (Route 2-16) that provides service between the Intermodal Center in Pittsfield and the Prime Outlets in Lee, via Lenox at Center. Bus connections are available that continue to Great Barrington and Stockbridge to the south and North Adams to the north. Route 2-16 runs hourly from 7:00 AM to 6:00 PM on weekdays and from 8:00 AM to 6:30 PM on Saturdays. Designated stops within the study area are located at the Stop &

Shop Plaza (off Dan Fox Drive) and the Center at Lenox shopping plaza. These stops are illustrated on Figure 2-5.

The BRTA charges $1.25 per zone (i.e. per Town traveled through) with free transfers. Half fares are available for individuals over the age of 60 or for the disabled. Children under 5 years of age and personal care assistants for disabled riders travel for free.

One of the major issues with the current bus service along this corridor is that the City/Town line divides the corridor, which results in an additional $1.25 fare to riders. To avoid this, riders sometimes notify the bus driver to stop at the Town/City line so this additional charge is not assessed. Currently this policy is being reviewed by the BRTA as busses stopping along the roadway and not at designated stops can create unsafe conditions along the corridor. The BRTA system maps and route data is included in the Appendix.

2.1.7 Pedestrian Accommodations

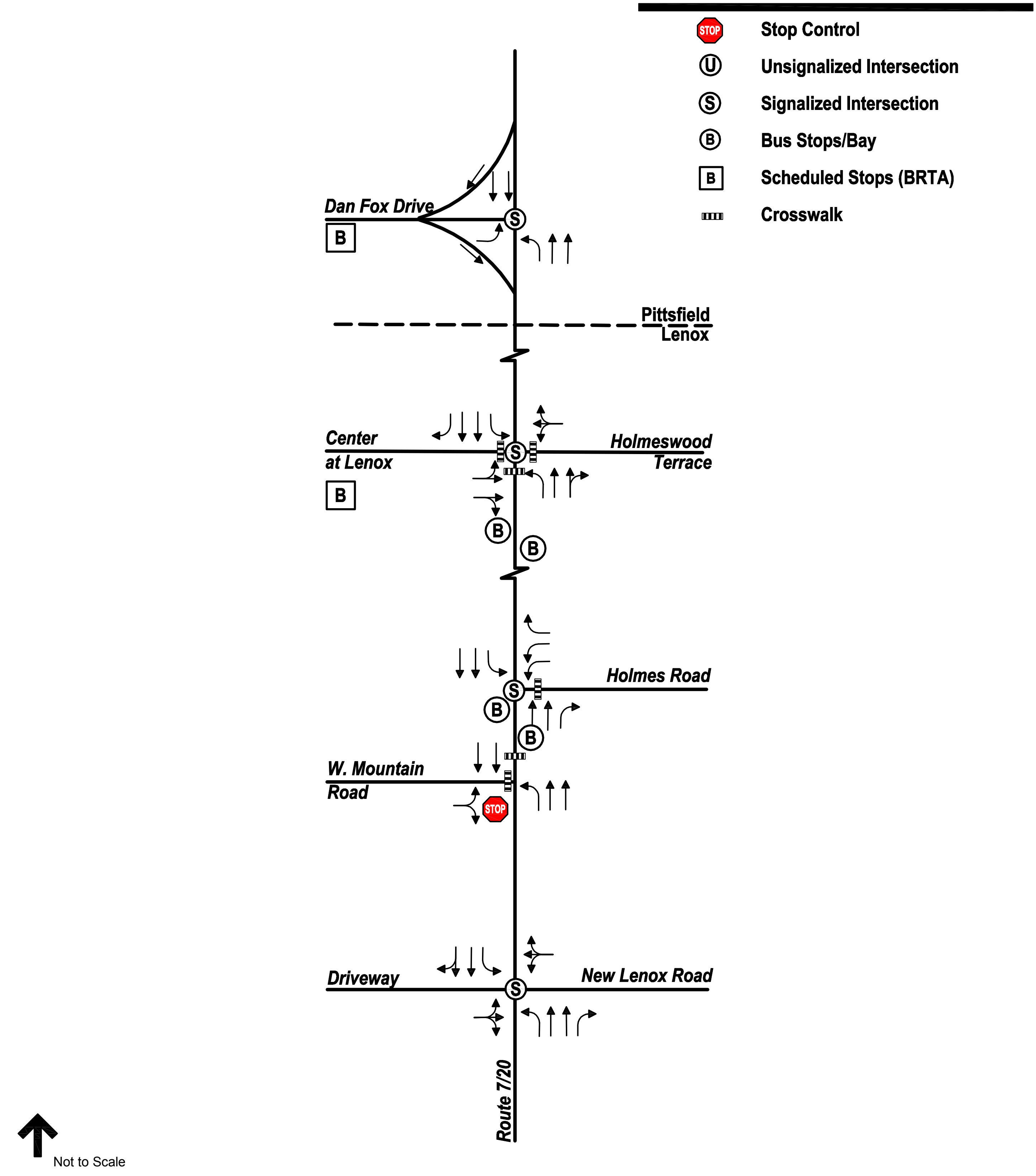
While there are sidewalks along both sides of the corridor, there is a lack of protected signalized pedestrian crossings. The following pedestrian accommodations were observed:

- While there are sidewalks along both sides of the study area, they do not extend beyond the study area limits, and end at New Lenox Road and just south of Dan Fox Drive.
- Sidewalks are not provided on any of the streets off of Route 7/20 including New Lenox Road, Holmes Road or Dan Fox Drive.
- There are residential areas along Route 7/20 just to the south of New Lenox Road that are within walking distance of the study area, however have no defined pedestrian connection to the corridor;
- The only signalized crossing of Route 7/20 within the study area is located at the Center at Lenox, with a crosswalk on the south side of the intersection and an exclusive pedestrian phase provided. There are crosswalks provided along the side street approaches at this intersection, however, they are not signalized.
- A crosswalk is provided across Holmes Road, but pedestrian push-buttons are not provided.

- There is also an unsignalized crosswalk across West Mountain Road, and an unsignalized pedestrian crossing exists across Route 7/20 approximately 160 feet to the north of this intersection.

2.1.8 Bicycle Accommodations

There are no designated bicycle facilities within the study area. Route 7/20 provides approximately 2-foot shoulders on both sides of the roadway throughout the corridor; therefore a bicyclist is forced to share the roadway with the driver. These 2-foot shoulders also exist along other areas of Route 7/20 that are not within the study area. These narrow shoulders are consistent throughout the corridor, both north and south of the study area. A striped bicycle lane is typically 5 feet wide, while 4-foot striped shoulders are considered adequate to provide bicycle accommodations.



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Lane Use and Roadway Characteristics — Figure 2-5

Route 7/20 Corridor
Access Management Plan

2.2 Environmental Resources

The environmental resources discussed in this chapter will help guide the development of alternatives so that impacts to the environment are avoided, minimized, or appropriately mitigated. As described in more detail in this section, the key environmental resources and sensitive areas that were reviewed included:

- Wetlands and floodplains;
- Water supply protection areas;
- Rare species and vernal pools;
- Historic and archaeological resources;
- Protected recreation/conservation land;
- Hazardous material and solid waste facility sites; and
- Environmental justice populations.

Environmental resource mapping for the study area was developed primarily through obtaining data layers from the MassGIS website (http://www.state.ma.us/mgis/massgis.htm). Figure 2-6 depicts the range of environmental resources, constraints, and sensitive areas in the study area.

The following provides a summary of key areas along the corridor:

- There is an existing wetland located off the corridor just to the north (and west) of the New Lenox Road intersection.

- The Route 7/20 corridor crosses the Yukon Brook approximately 400 feet south of the intersection of Holmes Road. The brook traverses the Route 7/20 corridor to the north and is immediately to the west of the intersection with Holmes Road.

- There is a wetland located just to the north, but on the easterly side of the roadway, of the Hampton Inn driveway.

- There is a significant grade change between the edge of the roadway and the property adjacent to the corridor just south of Dan Fox Drive.

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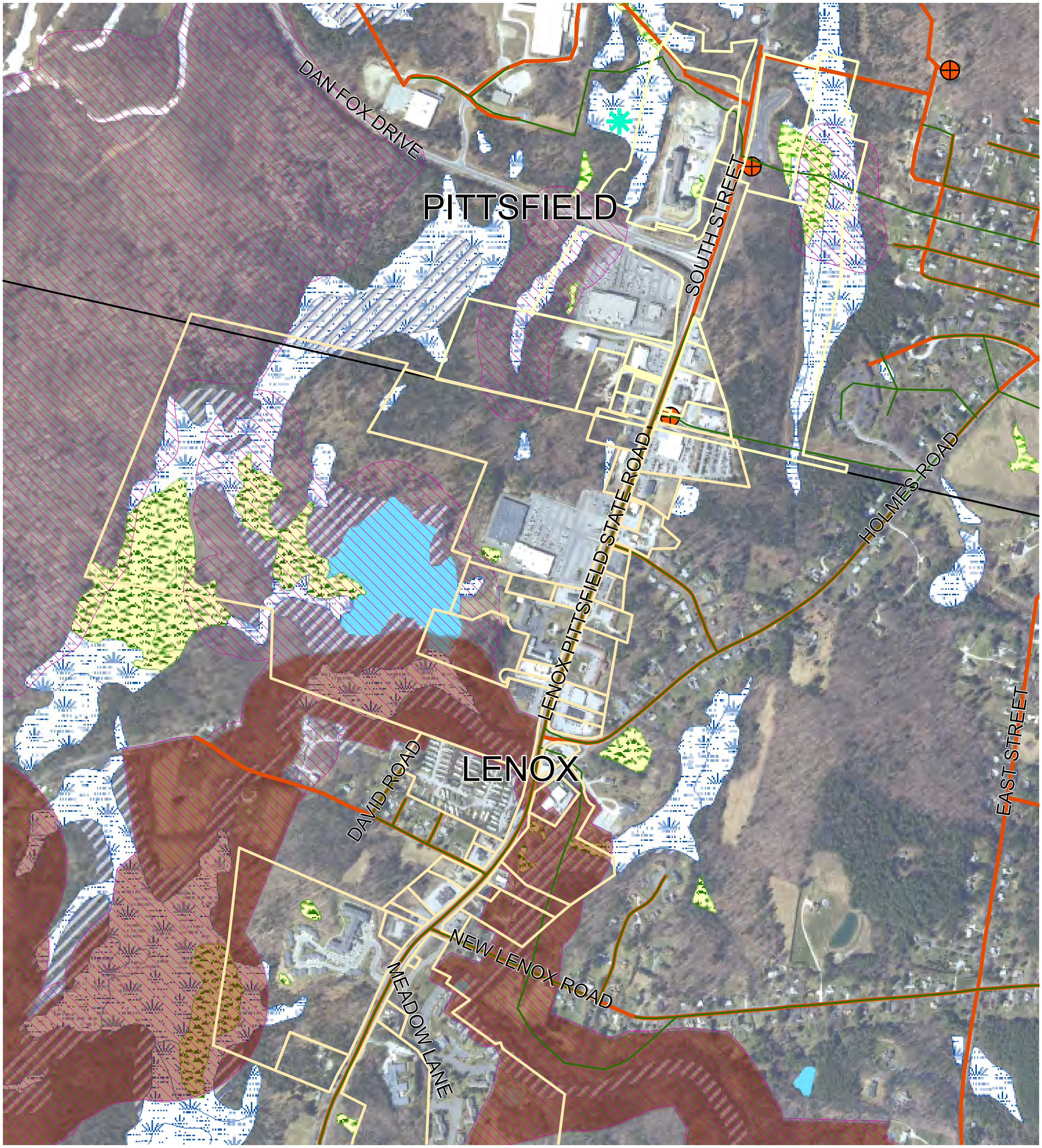

Source: Mass GIS, Berkshire County, Town of Lenox, City of Pittsfield

Legend

- LenoxCorridorProperty_update
- Town Boundaries
- Certified Vernal Pools 2009
- Wastewater_Standard
- Water Points
- Water_Standard
- Priority Habitats of Rare Species 2008
- Estimated Habitats of Rare Wildlife 2008
- FEMA 100yr floodplain
- Open Water
- Bog
- Marsh
- Swamp

0 510 1,020 Feet

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FIGURE 2-6
Environmental Constraints

Rte 7/20 Corridor
Access Management Plan

2.3 Existing Traffic Volumes

This section includes an evaluation of the existing traffic volumes within the study corridor and provides a general discussion on how traffic volumes along the Route 7/20 corridor have fluctuated over the past several years as well as month-to-month. All traffic data that was obtained as part of this access management plan can be found in the Appendix.

2.3.1 Historical Traffic Volumes

In reviewing the previously described transportation studies, VHB developed a summary of the relevant traffic data along the corridor that provides an accurate representation of traffic growth for the corridor. After further review of the traffic data that was available, it was determined that the traffic history provided by MassDOT for Route 7/20 at permanent count station 40 (just north of Route 7A) provides the most historic and complete data for conducting this assessment. Monthly traffic data was available for each month of three out of the last four years extending from 2005 through 2008. This data is summarized in Table 2-3 to illustrate the fluctuations in traffic along the corridor.

Table 2-3
Historical Average Annual Daily Traffic Volumes (AADT)

	Date of Count		Average Annual Traffic Volume		Annual Average Traffic Growth
MassDOT Permanent STA 40	First Count	Last Count	First Count	Last Count	per Year
Route 7/20 – north of Route 7A	2005	2006	24,800	25,500	+ 2.8 %
	2006	2008	25,500	22,250	- 5.0 %
Summary	2005	2008	24,800	22,250	- 2.5 %

Source: MassDOT monthly traffic count data for Route 7/20, located at permanent count station 40 just north of Route 7A.

2.3.2 Observed Traffic Volumes

Looking at how vehicle traffic fluctuates over a typical weekday provides insight into when peak periods occur and the intensity of traffic. Automatic traffic recorder (ATR) data were obtained for a typical weekday to quantify hourly fluctuations. Peak hour manual turning movement counts were conducted and used to determine existing traffic operations within the corridor.

Daily Traffic Volumes

Automatic traffic recorders (ATR's) were deployed by MassDOT along Route 7/20 just north of Holmes Road to collect hourly directional data over a 7-day period in November 2009. Table 2-4 summarizes the data that was collected as part of this effort. The ATR also collected data on the total usage of the center two-way left-turn lane (TWLTL). Traffic using the center left-turn lane totaled approximately 635 vehicles on a weekday.

Table 2-4
Route 7/20 Observed Traffic Volume Summary

	Daily [1]	Weekday Morning Peak Hour			Weekday Evening Peak Hour			Daily	Saturday Midday Peak Hour		
Location	Weekday	Volume [2]	K Factor [3]	Dir Dist [4]	Volume	K Factor	Dir Dist	Saturday	Volume	K Factor	Dir Dist
November 2009 North of Holmes Road	21,900	1,560	7.1	58% NB	1,800	8.3	53% SB	18,100	1,520	8.4	51% NB
August 2008 North of Center at Lenox	23,900	1,560	6.5	52% SB	1,700	7.1	51% SB	21,400	1,570	7.3	51% NB
March 2008 North of Center at Lenox	22,700	1,480	6.5	53% NB	1,860	8.2	52% NB	17,500	1,400	8.0	53% NB

Source: Automatic Traffic Recorder Counts: November 2009 collected by MassDOT, August 2008 and March 2008 collected as part of the Center at Lenox redevelopment project and as reported in the October 2008 Environmental Notification Form (ENF) filed under MEPA.
1 average daily traffic volume expressed in vehicles per day
2 expressed in vehicles per hour
3 percent of daily traffic that occurs during the peak hour
4 directional distribution of peak hour traffic

Figures 2-7 and 2-8 were also prepared to illustrate the average hourly and directional distributions for a weekday and a Saturday, respectively. As can be seen in Figure 2-7, distinct peaks occur at approximately 9:00AM and 4:00PM on an average weekday. It should be noted that the disparity in volumes between peak periods and off-peak periods is not as pronounced in this area as would be expected in a more developed and/or concentrated urban area. This may reflect different commuting patterns than a typical urban area, as can be detected by the near 50/50 split of northbound and southbound vehicles during the peak commuting periods. In larger and more concentrated urban areas the majority of traffic enters in the morning and exits in the evening, where in the case of the Route 7/20 corridor, it appears that similar amounts of commuters are making their way south, likely to the MassPike (I-90), and north, to Pittsfield which is the employment leader in the region. On Saturday the peak traffic volume occurs at approximately noon.

Figure 2-7: Hourly Traffic Distribution – Weekday

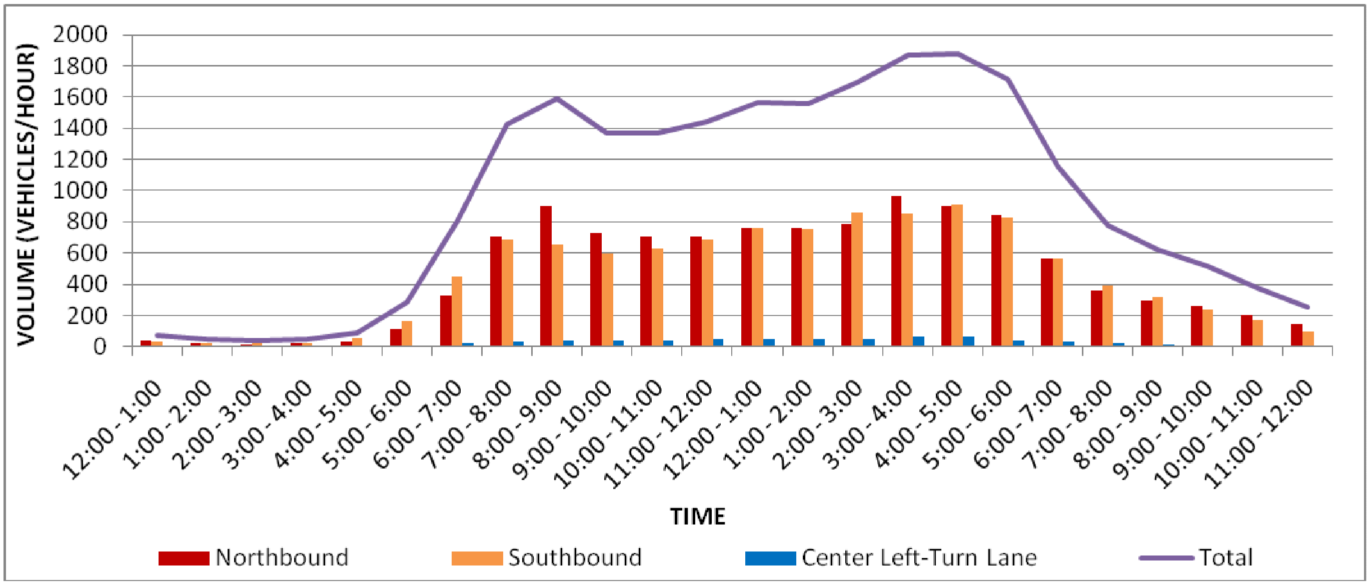
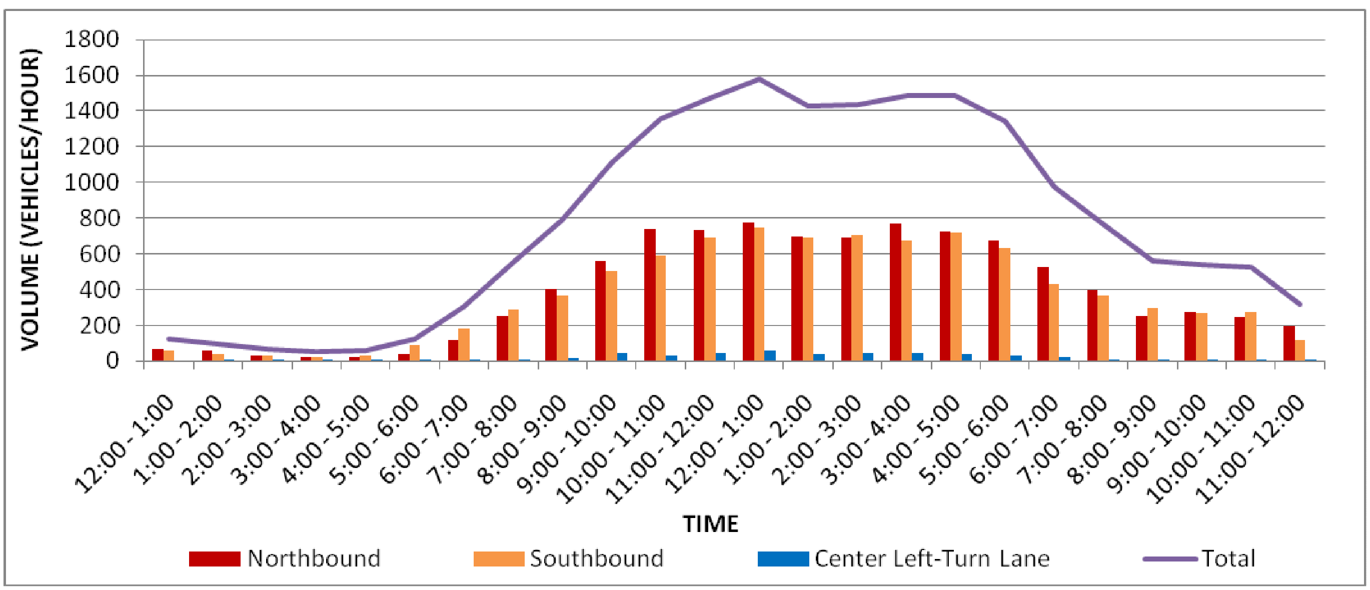


Figure 2-8: Hourly Traffic Distribution – Saturday



Peak Hour Volumes

Peak hour turning movement counts were collected at the following study area intersections:

1. New Lenox Road (signalized intersection);
2. West Mountain Road (unsignalized intersection);
3. Holmes Road (signalized intersection);
4. Center at Lenox Shopping Plaza/Holmeswood Terrace (signalized intersection); and
5. Dan Fox Road (signalized intersection).

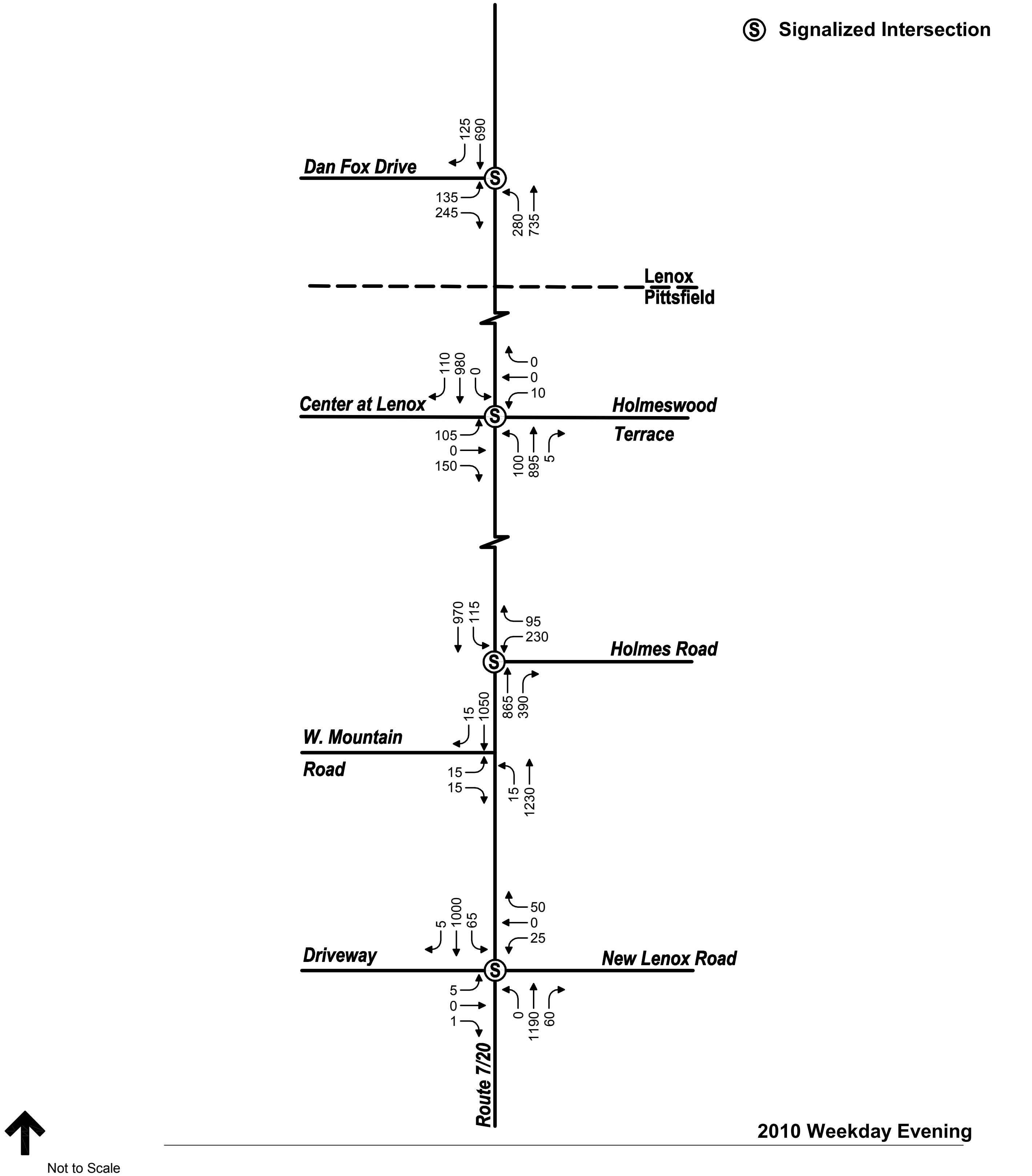
In addition to these intersections, VHB collected traffic volumes at a number of driveways between each of these intersections. Traffic counts for the above referenced intersections (and driveways) were collected during the weekday morning, weekday evening and/or Saturday midday peak periods. The turning movements are summarized in Figures 2-9 and 2-10.

Gap Study

Lastly, as part of the data collection effort, a vehicle gap study was performed during the weekday morning, weekday evening and Saturday midday peak hours at the Guido's and Shell Station/Dunkin Donuts driveways just to the south of Dan Fox Drive. This data was collected to make an assessment as to how aggressive drivers are when accessing the Route 7/20 corridor from side streets or driveway curb cuts. This information could provide information as to why this area has a higher crash occurrence than other areas along the corridor. The following summarizes this data collection effort.

Frequency and Size of Route 7/20 Vehicle Gaps

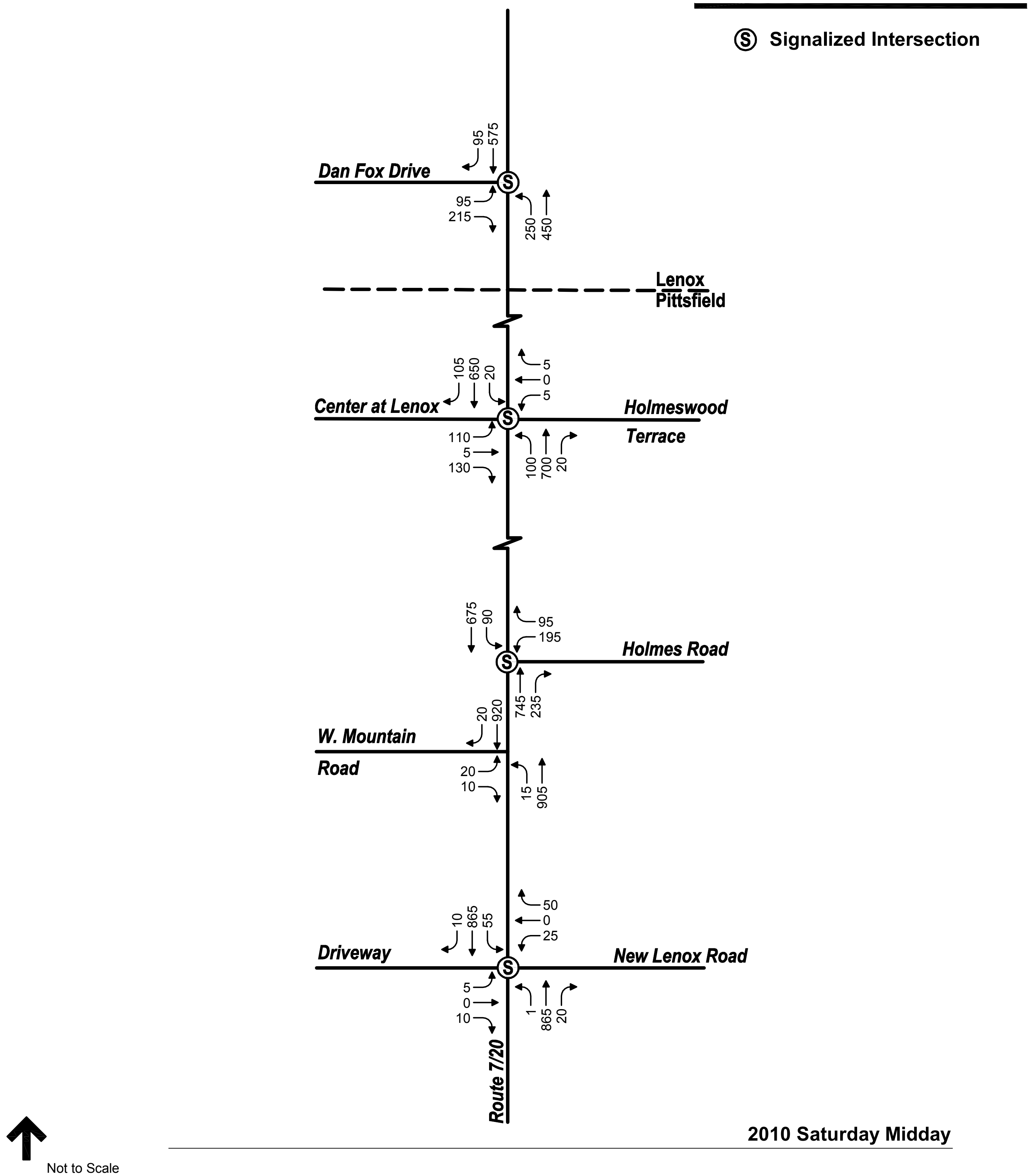
The driveways where this data was collected, are the busiest unsignalized driveways along the corridor, and therefore provided the largest sample size of driver's characteristics for accessing the Route 7/20 corridor (i.e. gap acceptance). The collected gap data was broken down in two stages. First, the total number of gaps was broken down into two second intervals. This data were further broken down to identify gaps in the Route 7/20 northbound and southbound (separate directions) traffic streams, and then again into gaps that combined the northbound and southbound directions. This data is summarized in Tables 2-5 and 2-6. The raw gap data is included in the Appendix.



2010 Existing Peak Hour Traffic Volumes

Figure 2-9

Route 7/20 Corridor Access Management Plan



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2010 Existing Peak Hour
Traffic Volumes

Figure 2-10

Route 7/20 Corridor
Access Management Plan

Table 2-5
Frequency and Size of Observed Gaps: Weekday Evening Peak Hour

Gap Duration (seconds)	Route 7/20 Northbound*		Route 7/20 Southbound*		Combined^	
	Total Gaps	Percent of Total	Total Gaps	Percent of Total	Total Gaps	Percent of Total
≤ 2	886	59 %	792	58 %	2,228	79 %
3-4	232	16 %	216	16 %	328	12 %
5-6	123	8 %	106	8 %	120	4 %
7-8	68	5 %	62	4 %	64	2 %
9-10	43	3 %	41	3 %	39	1 %
11-12	32	2 %	35	2 %	16	1 %
13-14	20	1 %	25	2 %	10	0 %
≥15	85	6 %	95	7 %	36	1 %
Total	1,489	100%	1,372	100 %	2,841	100 %

Note: gaps in the PM Peak were observed for vehicles exiting both the Exit driveway of the Guido's Market and Shell Gas Station.
The shaded area indicates gaps that driver's typically accept, and is based on industry standards set in the 2000 Highway Capacity Manual.
* Route 7/20 Gaps in the northbound or southbound directions (separate) are gaps that are accepted by right-turning vehicles.
^ Route 7/20 Gaps in the southbound and southbound directions (combined) are gaps that are accepted by left-turning vehicles.

Table 2-6
Frequency and Size of Observed Gaps: Saturday Midday Peak Hour

Gap Duration (seconds)	Route 7/20 Northbound*		Route 7/20 Southbound**		Combined^	
	Total Gaps	Percent of Total	Total Gaps	Percent of Total	Total Gaps	Percent of Total
≤ 2	769	58 %	726	52 %	1,824	72 %
3-4	117	9 %	150	11 %	248	10 %
5-6	139	11 %	161	12 %	233	9 %
7-8	75	6 %	88	7 %	91	4 %
9-10	46	3 %	70	5 %	51	2 %
11-12	17	1 %	27	2 %	19	1 %
13-14	27	2 %	29	2 %	23	1 %
≥15	139	10 %	124	9 %	36	1 %
Total		100%		100 %		100 %

Note: gaps in the PM Peak were observed for vehicles exiting both the Exit driveway of the Guido's Market and Shell Gas Station.
Note: gaps in the PM Peak were observed for vehicles exiting both the Exit driveway of the Guido's Market and Shell Gas Station.
The shaded area indicates gaps that driver's typically accept, and is based on industry standards set in the 2000 Highway Capacity Manual.
* Route 7/20 Gaps in the northbound or southbound directions (separate) are gaps that are accepted by right-turning vehicles.
^ Route 7/20 Gaps in the southbound and southbound directions (combined) are gaps that are accepted by left-turning vehicles.

The shaded data illustrated in the tables above indicate the following:

- During the weekday evening peak hour, an average of only 25-percent of all gaps for either the northbound or southbound directions are large enough to safely accommodate a right-turning vehicle from a driveway. This number is 35-percent during a Saturday midday peak hour.

- During the weekday evening peak hour, an average of only 9-percent of all gaps in the combined northbound and southbound directions are large enough to safely accommodate a left-turning vehicle from a driveway. This number is only 8-percent during a Saturday midday peak hour.

- This peak hour data indicates that there are a minimal number of gaps along the corridor that are large enough for a vehicle to safely enter the corridor. The peak hour data also indicates that it is much easier to make a right-turn from a driveway than it is to make a left-turn.

While the previous data indicates that there are a minimal number of acceptable gaps along the corridor, based on traffic industry standards, additional data was collected to identify the acceptable gap (or critical gap) for the Route 7/20 corridor. The next section summarizes this data collection effort.

Route 7/20 Critical Gap

The 2000 Highway Capacity Manual[2] states the following with respect to the critical gap:

"The critical gap, t_c, is defined as the minimum time interval in the major-street traffic stream that allows intersection entry for one minor-street vehicle (5). Thus, the driver's critical gap is the minimum gap that would be acceptable. A particular driver would reject any gaps less than the critical gap and would accept gaps greater than or equal to the critical gap. Estimates of critical gap can be made on the basis of observations of the largest rejected and smallest accepted gap for a given intersection."

During data collection, in all observed time periods, it was noted that a significant number of left turn vehicles used the center left-turn lane as an acceleration lane to aid in joining the traffic stream, which results in unreasonably small gaps (less than 3 seconds) being used to enter the traffic stream. To the other extreme, the relatively large amount of sight distance (particularly to the south) afforded drivers with the opportunity to reject a moderate to large gap if an even larger gap was observed downstream. These issues were taken into account when estimating the critical gap for the corridor.

When determining the critical gap for the corridor, it was determined that any accepted gap less than 4 seconds or rejected gap greater than nine seconds was a function of roadway geometry and should be discounted. In order to further account for extreme driver behavior (over aggressive or under aggressive), the

2 *2000 Highway Capacity Manual*; Transportation Research Board Special Report 209; Washington, D.C.; 2000.

85th percentile was determined for both the accepted gaps and the rejected gaps. This eliminated data for over aggressive drivers accepting smaller gaps as well as data for overly cautious drivers that rejected larger gaps. This methodology resulted in a critical gap for left-turning vehicles of approximately 4.5 seconds, while for right-turning vehicles the critical gap was slightly higher at approximately 4.8 seconds. This suggests that drivers attempting to make a left-turn from a private retail driveway onto Route 7/20 act in a more aggressive manner than those making a right-turn.

The data summarized in Figures 2-11, 2-12, 2-13, and 2-14 allows for an estimate of the critical gap from the perspective of drivers utilizing these busiest driveways during the peak hours.

Figure 2-11: Route 7/20 Vehicle Gaps
Weekday Evening Right-Turns Guido's Market and Shell Driveways

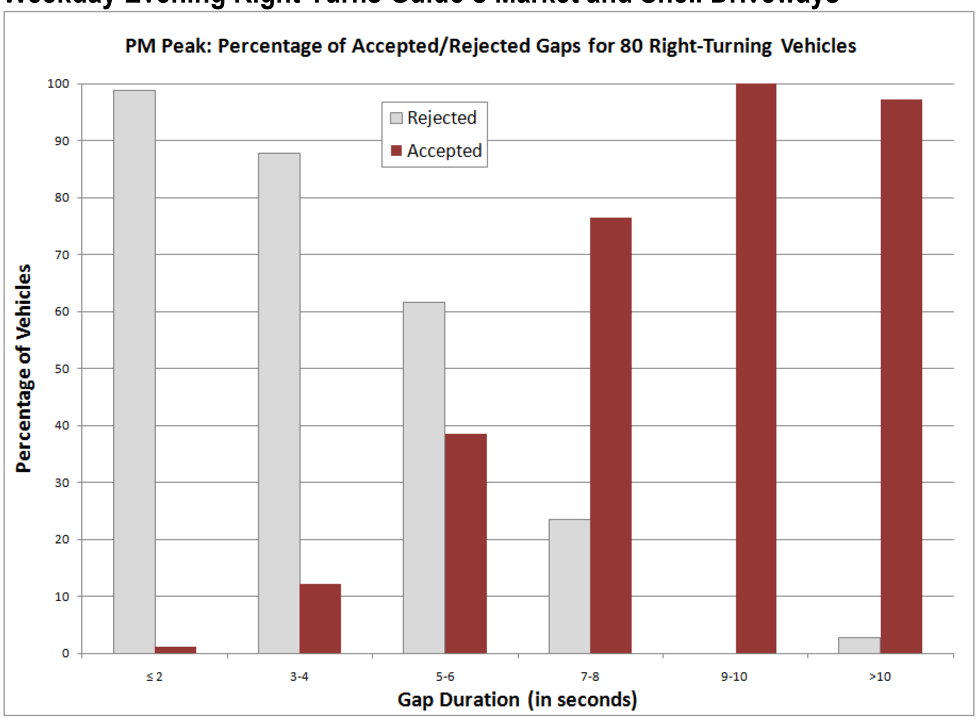


Figure 2-12: Route 7/20 Vehicle Gaps
Weekday Evening Left-Turns Guido's Market and Shell Driveways

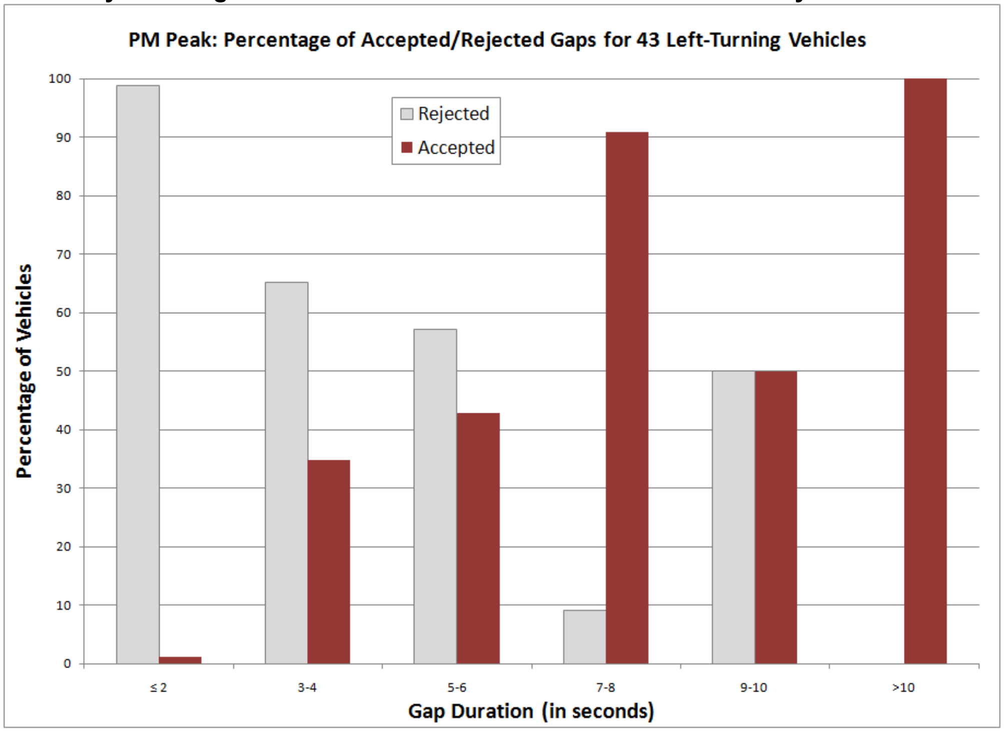


Figure 2-13: Route 7/20 Vehicle Gaps
Saturday Midday Right-Turns Guido's Market and Shell Driveways

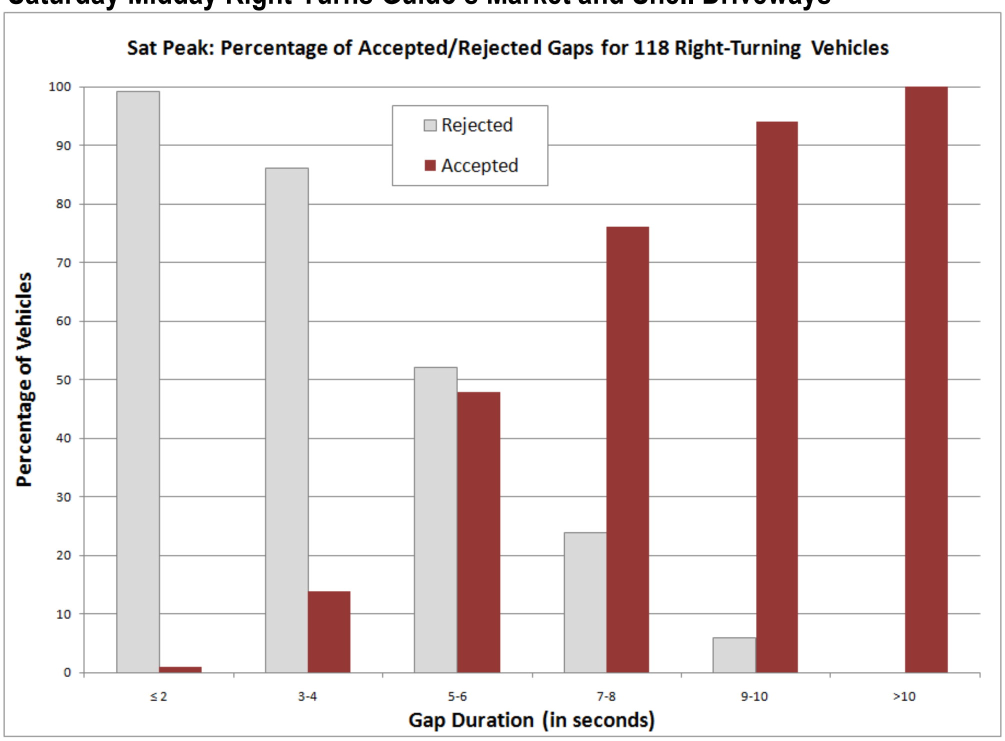
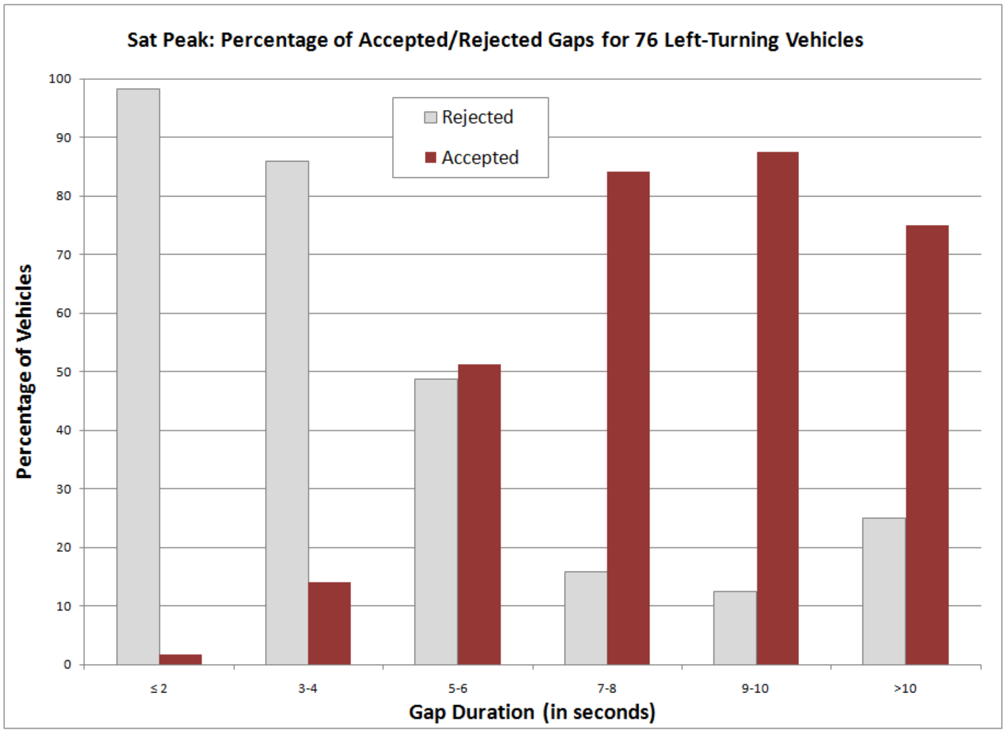


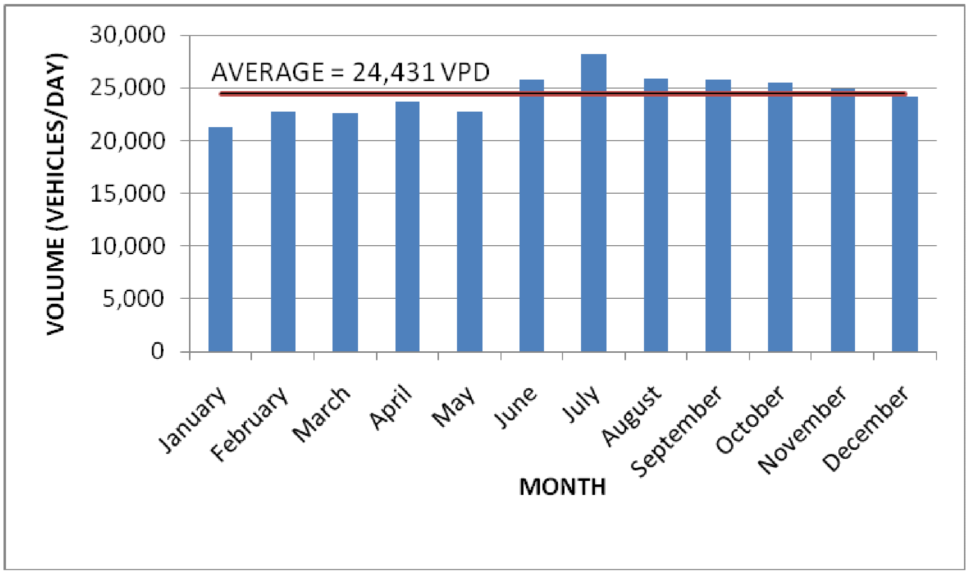
Figure 2-14: Route 7/20 Vehicle Gaps
Saturday Midday Left-Turns Guido's Market and Shell Driveways



2.3.3 Seasonal Variation

To quantify the seasonal variation of traffic volumes in the region, monthly historic traffic data available from MassDOT was reviewed. Figure 2-15 provides a summary of the monthly traffic counts for the most recent full year (2008) of data. This information was collected at a MassDOT permanent count station 40 on Route 7/20 in Lenox (just north of Route 7A). According to the monthly data, February and March traffic volumes are approximately 7-percent lower than average month conditions. Therefore, since the traffic counts for this study were collected during these months, they were adjusted upward to reflect average month conditions. This adjustment will provide a more accurate and conservative analysis for this study.

Figure 2-15: Traffic Data – Seasonal Variation



Source: MassDOT permanent count station 40 from 2005 to 2008.

2.4 Safety Assessment

A safety assessment was conducted for the key intersections within the study area, as well as the roadway segments between the key intersections, to help determine if the traffic demands combined with geometric conditions raise potential safety concerns for vehicles, pedestrians, and bicyclists.

The safety analysis was based on an examination of vehicular crash history on the roadway and evaluating the number of crashes and crash rates for each intersection or segment of roadway. Crash data were supplied by MassDOT, the Town of Lenox and the City of Pittsfield. The following summarizes the data that was obtained as part of this effort:

- MassDOT – January 2006 to December 2008;
- Town of Lenox – February 2007 to February 2010; and
- City of Pittsfield – February 2007 to February 2010.

Tables 2-7 and 2-8 provide a summary of the crash data provided by MassDOT, the Town of Lenox and the City of Pittsfield. Previous Figures 2-2 and 2-3 show the distribution of crashes in key locations within the study area. There were a total of 105 incidents that were observed along the entire corridor, this combines data from all sources obtained.

The MassDOT Statewide average crash rates for signalized and unsignalized intersections are 0.82 and 0.62, respectively. A crash rate higher than the statewide average suggests that existing conditions, such as roadway geometry or existing signal phasing, may be influencing the number or type of crashes at a particular intersection. Crash rates can also be calculated for roadway segments. The statewide average crash rate for a principal arterial in an urban area, which is the classification for Route 7/20, is 2.30 crashes. Calculating the crash rates for particular roadway segments helps provide a view of the overall corridor and potential problem areas, where no one location or issue may be singled out. Intersection crash rates are calculated as crashes per million vehicles entering the intersection, where as roadway segment crash rates are based on the number of crashes per million vehicle miles traveled. Crash rate calculation sheets are provided in the Appendix.

As shown in Tables 2-7 and 2-8 below, none of the key intersections located within the study area have a calculated crash rate higher than the State average suggesting that overall the intersections are operating in a safe manner.

The intersection of Route 7/20 with Holmes Road had the highest number of intersection-oriented crashes with 23, based on the Town of Lenox data. Of the crashes occurring at the Holmes Road intersection approximately 45-percent were classified as angle crashes. Additionally, approximately 40-percent of all crashes at this intersection involved vehicles attempting to make a left turn from Route 7/20 southbound onto Holmes Road. This may suggest issues with the signal phasing and timings as well as high vehicle operating speeds along Route 7/20. Overall, the high number of angle crashes at this location could suggest that the current protected-permissive phasing for the southbound left-turn movement from Route 7/20 onto Holmes Road should be revisited. This movement should be closely monitored in the future.

Table 2-7
MassDOT Vehicular Crash Summary: 2006 to 2008

	New Lenox Road	West Mountain Road	Holmes Road	Holmeswood Terrrace	Dan Fox Drive
Signalized?	Yes	No	Yes	Yes	Yes
State Average Crash Rate	0.82	0.62	0.82	0.82	0.82
State Calculated Crash Rate	0.27	0.14	0.49	0.03	0.55
Exceeds?	No	No	No	No	No
Year					
2006	5	1	4	0	7
2007	2	2	6	0	4
2008	1	1	6	1	3
Total	8	4	16	1	14
Collision Type					
Angle	2	2	7	0	3
Head-on	0	0	0	1	0
Rear-end	1	1	3	0	8
Sideswipe	2	0	2	0	1
Single-vehicle crash	0	0	1	0	2
Unknown	3	1	3	0	0
Total	8	4	16	1	14
Severity					
Fatality	0	0	0	0	0
Injury	1	2	2	1	7
Property-related	3	1	8	0	7
Unknown	4	1	5	0	0
Total	8	4	16	1	14
Time of day					
Weekday, 7:00 AM - 9:00 AM	0	2	2	0	3
Weekday, 4:00 PM - 6:00 PM	3	1	1	0	1
Saturday, 11:00 AM - 2:00 PM	0	0	1	0	1
Weekday, other time	5	1	9	1	7
Weekend, other time	0	0	3	0	2
Total	8	4	16	1	14
Pavement Conditions					
Dry	2	2	8	0	10
Wet	2	1	4	0	3
Snow	0	0	0	1	1
Ice/Slush	0	0	0	0	0
Other	0	1	1	0	0
Unknown	4	0	3	0	0
Total	8	4	16	1	14

Source: MassDOT crash data.

Table 2-8
Town/City Corridor Crash Data – February 2007 to February 2010

Town/City	Type	Location	Total Crashes	Length (in feet)	Crash Rate
Lenox	Segment	North of New Lenox Road to South of Holmes Road	22	1,425	3.61
Lenox	Segment	North of Holmes Road to South of Center at Lenox	5	1,480	0.79
Lenox/Pittsfield	Segment	North of Center at Lenox to South of Dan Fox Drive	27	1,585	3.99
Lenox	Intersection	New Lenox Road	8	NA	0.27
Lenox	Intersection	West Mountain Road	4	NA	0.14
Lenox	Intersection	Holmes Road	23	NA	0.71
Lenox	Intersection	Center at Lenox	6	NA	0.21
Pittsfield	Intersection	Dan Fox Dr	8	NA	0.31

Source: Town of Lenox and City of Pittsfield Police Departments.
Notes: Crash rates were calculated using MassDOT methodology for intersections and roadway segments. Segment crash rates does not include incidents reported at each intersection beginning and ending at a defined segment, and all unsignalized intersections and driveways between these beginning and ending points have been included; i.e. the 4 incidents listed at the intersection of West Mountain Road are included in the first segment listed above between New Lenox Road and Holmes Road.

As is shown in Table 2-8 there are a significant number of crashes that occur on the segments of roadway between the key intersections. Of particular concern are the segments of Route 7/20 between New Lenox road and Holmes Road, and between the Center at Lenox and Dan Fox Drive. The following summarizes this data:

- The segment of Route 7/20 between New Lenox Road and Holmes Road was determined to have a crash rate of 3.61, which higher than the statewide average of 2.30.
- The segment between the Center at Lenox and Dan Fox Drive had an overall crash rate of approximately 3.99, which is also higher than the statewide average of 2.30.
- Two of the three segments of Route 7/20 were noted to have fatal incidents. These segments are discussed below.

The following areas along the corridor were highlighted as areas with safety concerns. Each area included a pedestrian fatality.

- Just to the north of West Mountain Road there were a total of 12 crashes between 2007 and 2010, based on data provided by the Town. Of those, at least 5 involved pedestrian activity, including the fatal crash where a pedestrian was struck by a vehicle. The other crashes at this location often involved vehicles being rear-ended when stopped for a pedestrian in the crosswalk located north of Arizona Pizza. This pattern is likely due to drivers being unaware of the crosswalk and not expecting to encounter pedestrians crossing Route 7/20. More details on this crossing are provided in Chapter 6.

- The segment of Route 7/20 between Center at Lenox and Dan Fox Drive has the highest density of curb-cuts along the entire corridor. The total of 27 crashes along this segment is likely a function of the heavy interaction between the driveways and traffic traveling along Route 7/20. The majority of crashes in this area involved vehicles turning to/from driveways and making lane changes, which is consistent with the high density of curb cuts. Also, based on the gap data collected as part of this study, it was noted that drivers exiting the driveways are acting in a more aggressive manner in order to maneuver across multiple lanes of traffic, which likely contributes to the high number of crashes in this area. The aggressive behavior noted includes using shorter gaps in the traffic stream to pull out of driveways as well as utilizing the center turn lane as an acceleration lane when making a left-turn and merging into traffic. This area also had a fatality where a pedestrian was attempting to cross Route 7/20 at an unmarked location and early in the morning.

2.5 Existing Intersection Operations

Understanding the relationship between the supply and demand on a roadway is a fundamental consideration in evaluating how well a transportation facility safely and efficiently accommodates the traveling public. Methods from the 2000 Highway Capacity Manual[3] were used to evaluate how the intersections accommodate the traffic demands under existing conditions.

Using the traffic counts and field measurements, a traffic operations model was used to evaluate how well the transportation infrastructure handles the peak hour demands. The term "Level of Service" (LOS) is used to denote the different operating conditions that occur under peak traffic volume loads. It is a qualitative measure that considers a number of factors including traffic demands, roadway geometry, speed, travel delay, and freedom to maneuver. The level of service designation is an index that is based on vehicle delays, ranging from A to F, with LOS A representing the best operating conditions and LOS F representing the worst operating conditions. Typically, LOS D (as defined in the 2000 Highway Capacity Manual) is considered to be the acceptable limit. LOS E or F conditions are generally considered unacceptable, except for low volume

3 *2000 Highway Capacity Manual*; Transportation Research Board Special Report 209; Washington, D.C.; 2000.

movements where progression on the main street takes priority over low volume side street movements.

In addition to LOS, three other measures of effectiveness (MOEs) are typically used to quantify the traffic operations at intersections; delay (expressed in seconds per vehicle), volume-to-capacity ratio (v/c), and queues (expressed in feet). These measures evaluate supply and capacity for each lane group for the key intersections located within the study area. The following defines each MOE:

- **Delay –** The total average delay to drivers, including deceleration, queue maneuvering, and acceleration delays.

- **V/C –** The volume-to-capacity ratio is a measure that compares the observed volume of traffic to the theoretical processing capacity of the intersection. When the V/C ratio exceeds 1.0, the volume of traffic exceeds the theoretical capacity.

- **LOS –** Level of service is a rating based on the delay. LOS E and F are typically considered unacceptable and warrant further review.

- **Queue –** The average and maximum observed queue lengths.

The following provides a more detailed explanation of the v/c and delay MOEs. An existing v/c ratio of 0.9 for an intersection indicates that the intersection is operating at 90 percent of its available capacity. A delay of 15 seconds for a particular vehicular movement or approach indicates that vehicles on the movement or approach will experience an average additional travel time of 15 seconds. It should be noted that v/c and delay could have a range of values for a given LOS letter designation. Comparison of intersection capacity results therefore requires that, in addition to the LOS, the other MOEs should also be considered. The next section provides additional details on the level-of-service criteria.

2.5.1 Level-Of-Service Criteria

Level-of-service (LOS) is the term used to denote the different operating conditions which occur on a given roadway segment under various traffic volume loads. It is a qualitative measure of a number of factors including roadway geometrics, speed, travel delay, freedom to maneuver, and safety. Level-of-service provides an index to the operational qualities of a roadway segment or an intersection. Level-of-service designations range from A to F, with

LOS A representing the best operating conditions and LOS F representing the worst operating conditions.

For this study, capacity analyses were completed for the signalized and unsignalized intersections within the study area. The LOS designation is reported differently for signalized and unsignalized intersections. For signalized intersections, the analysis considers the operation of each lane or lane group entering the intersection and the LOS designation is for overall conditions at the intersection. For unsignalized intersections, the analysis assumes that traffic on the mainline is not affected by traffic on side streets. The LOS is only determined for left-turns from the main street and all movements from the minor street. The evaluation criteria used to analyze intersections is based on the *Highway Capacity Manual* (HCM)[4]. Table 2-9 provides a summary of the delay criteria versus LOS.

Table 2-9
Level of Service Criteria

Level of Service	Signalized Intersection (delay)	Unsignalized Intersection (delay)
A	0 to 10 seconds	0 to 10 seconds
B	10 to 20 seconds	10 to 15 seconds
C	20 to 35 seconds	15 to 25 seconds
D	35 to 55 seconds	25 to 35 seconds
E	55 to 80 seconds	35 to 50 seconds
F	Greater than 80 seconds	Greater than 50 seconds

Source: 2000 Highway Capacity Manual Exhibits 16-2 and 17-2

2.5.2 Signalized Intersections Capacity Analysis

A capacity analysis was conducted for the study area signalized intersections for the 2010 Existing traffic conditions; see Table 2-10. The Synchro capacity analysis worksheets are located at the end of the Appendix.

Based on the summary provided in Table 2-10, all signalized intersections within the study area currently operate at LOS B or better overall, with all individual movements operating at LOS C or better. The largest queues noted are the northbound queue at the intersection of New Lenox Road and the southbound queue at Dan Fox Drive.

[4] Highway Capacity Manual; Transportation Research Board; Washington D.C.; 2000.

Table 2-10
Signalized Intersection Capacity Analysis Summary — 2010 Existing Conditions

		Weekday Evening Peak Hour					Saturday Midday Peak Hour				
Intersection	Lane Group	V/C[1]	Delay[2]	LOS[3]	Q (ft)[4]	Q (veh)[5]	V/C	Delay	LOS	Q (ft)	Q (veh)
New Lenox Road and	NB LT	0.00	0.0	A	0	0	0.00	8.4	A	2	1
Five Chairs Restaurant	NB TH	0.74	16.1	B	275	11	0.53	12.5	B	173	7
	NB RT	0.04	8.7	A	16	1	0.01	8.5	A	10	1
	SB LT	0.15	4.2	A	10	1	0.10	1.8	A	9	1
	SB TH-RT	0.40	1.1	A	39	2	0.35	1.3	A	42	2
	EB LT-TH-RT	0.09	27.8	C	8	1	0.07	27.8	C	13	1
	WB LT-TH-RT	0.25	28.4	C	41	2	0.24	28.4	C	43	2
	Overall	**0.62**	**9.9**	**A**	**-**	**-**	**0.47**	**7.9**	**A**	**-**	**-**
Holmes Road	NB TH	0.49	1.7	A	16	1	0.39	1.7	A	18	1
	NB RT	0.26	0.3	A	m0	0	0.15	0.2	A	0	0
	SB LT	0.30	2.1	A	15	1	0.21	3.4	A	23	1
	SB TH	0.42	1.4	A	31	2	0.29	3.6	A	72	3
	WB LT	0.55	26.4	C	75	3	0.48	26.6	C	68	3
	WB RT	0.13	16.5	B	33	2	0.07	17.3	B	28	2
	Overall	**0.51**	**4.3**	**A**	**-**	**-**	**0.41**	**5.5**	**A**	**-**	**-**
Center at Lenox and	NB LT	0.31	1.3	A	5	1	0.19	5.4	A	32	2
Holmeswood Terrace	NB TH-RT	0.39	1.5	A	5	1	0.33	4.8	A	96	4
	SB LT	0.01	4.1	A	m1	1	0.07	8.7	A	18	1
	SB TH	0.54	5.5	A	92	4	0.41	10.7	B	143	6
	SB RT	0.08	2.0	A	m2	1	0.07	8.5	A	26	1
	EB TH-LT	0.65	32.8	C	#100	4	0.60	25.7	C	78	3
	EB RT	0.10	24.9	C	46	2	0.10	20.8	C	28	1
	WB LT-TH-RT	0.06	24.7	C	19	1	0.03	20.5	C	10	1
	Overall	**0.56**	**6.2**	**A**	**-**	**-**	**0.41**	**10**	**B**	**-**	**-**
Dan Fox Drive	NB LT	0.75	24.9	C	98	4	0.72	18.9	B	m73	3
	NB TH	0.29	1.3	A	20	1	0.20	1.5	A	21	1
	SB TH	0.57	17.8	B	197	8	0.44	15.3	B	156	7
	SB RT	0.11	0.1	A	0	0	0.07	0.1	A	0	0
	EB LT	0.45	26.4	C	83	4	0.46	26.9	C	78	4
	EB RT	0.31	12.0	B	76	4	0.29	12.7	B	66	3
	Overall	**0.61**	**12.1**	**B**	**-**	**-**	**0.53**	**11.6**	**B**	**-**	**-**

Source: VHB, Inc. using Synchro 7 (Build 763) software. This assessment does not account for the redevelopment of the Center at Lenox, which was under construction at the time of this analysis.
1 V/C – Volume-to-capacity ratio. V/C ratios range from 1.0 when demand equals capacity to 0 when demand is zero. Values over 1.0 indicate demand in excess of capacity.
2 Delay – Control delay per vehicle, expressed in seconds, includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay.
3 LOS – Level-of-Service. LOS A indicates free flow conditions with minimal delays. LOS E and F indicate congested conditions.
4 Q (ft) – 95th percentile queue length estimate, in feet.
5 Q (veh) – 95th percentile queue length estimate, in number of vehicles, assuming 25 feet per vehicle.
95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.
M Volume for 95th percentile queue is metered by upstream signal.
NB = Northbound; SB = Southbound; EB = Eastbound; WB = Westbound; LT = left-turn; TH = through; RT = right-turn; UT = u-turn

2.5.3 Unsignalized Intersection Capacity Analysis

In addition to the signalized intersections, an Existing conditions capacity analysis was conducted for the unsignalized intersection of Route 7/20 and West Mountain Road. Results of this analysis are provided in Table 2-11. The Synchro capacity analysis worksheets are located at the end of the Appendix.

The analytical methodologies typically used for the analysis of unsignalized intersections use conservative analysis parameters such as high critical gaps. Actual field observations conducted (on the northern portion of the corridor) as part of this study indicate that drivers on minor streets and driveways generally accept smaller gaps in traffic than the default values used in the analysis procedures and therefore could experience less delay than reported. Also, the analysis methodologies do not fully take into account the beneficial grouping or platooning effects caused by the nearby signalized intersection. The net effect of these analysis procedures could result in the over-estimation of calculated delays at unsignalized intersections. Cautious judgment should therefore be exercised when interpreting the capacity analysis results at unsignalized intersections.

Table 2-11
Unsignalized Intersection Capacity Analysis Summary — 2010 Existing Conditions

		Weekday Evening Peak Hour				Saturday Midday Peak Hour			
Intersection	Lane Group	Demand[1]	V/C[2]	Delay[3]	LOS[4]	Demand	V/C	Delay	LOS
West Mountain Road and	NB LT	15	0.03	10.7	B	15	0.03	10.8	B
Route 7/20	EB LT-RT	30	0.20	27.8	D	30	0.33	44.9	E

Source: VHB, Inc. using Synchro 7 (Build 763) software.
1 Demand – Vehicles-per-hour (vph).
2 V/C – Volume-to-capacity ratio. V/C ratios range from 1.0 when demand equals capacity to 0 when demand is zero. Values over 1.0 indicate demand in excess of capacity.
3 Delay – Control delay per vehicle, expressed in seconds, includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay.
4 LOS – Level-of-Service. LOS A indicates free flow conditions with minimal delays. LOS E and F indicate congested conditions.
NB = Northbound; SB = Southbound; EB = Eastbound; WB = Westbound; LT = left-turn; TH = through; RT = right-turn; UT = u-turn

The unsignalized capacity analysis summary provided in Table 2-11 indicates that during the weekday evening peak hour the critical movements operate at LOS D or better, while during the Saturday midday peak hour turning movements from West Mountain Road operate at LOS E. However, it is important to note that some local businesses indicated at the first public meeting that residents avoid turning left from West Mountain Road. It was specifically mentioned that vehicles turn right from West Mountain Road (instead of a left-turn) and then turn left into the business driveways near the New Lenox Road traffic signal to reverse direction. Although this movement was not observed in the field, this "U-turn" movement appears to be an easier maneuver to head northbound on Route 7/20 from West Mountain Road. Excessive vehicle speeds along the corridor appear to be the primary reason for this U-turn movement occurring.

2.6 Existing Traffic Conditions Summary

The following section provides a summary of the Existing Traffic Conditions noted along the corridor.

2.6.1 Intersection Operations

The following provides a summary of existing intersection-related issues that have been observed or discussed with business owners along the corridor:

- All signalized intersections within the corridor currently operate at LOS B or better, with all individual movements operating at LOS C or better.

- Holmes Road: The intersection of Route 7/20 with Holmes Road had the highest number of intersection-oriented crashes with 23, based on the Town of Lenox data. Of the crashes occurring at the Holmes Road intersection approximately 45-percent were classified as angle crashes. Additionally, approximately 40-percent of all crashes at this intersection involved vehicles attempting to make a left turn from Route 7/20 southbound onto Holmes Road. The majority of these appear to be a result of left-turn movements attempting to turn left across two lanes of northbound traffic. This movement currently operates with 7 seconds of protected green time and 30 seconds of permissive green time (not including clearance intervals).

- The only signalized pedestrian crossing of Route 7/20 within the study area is located across the northbound approach to the intersection with the Center at Lenox and Holmeswood Terrace.

2.6.2 Corridor Operations

The following provides a summary of existing issues that have been observed or discussed with business owners along the corridor:

- The overall corridor averages 61 access points per mile, which is high based on driveway spacing standards identified in the Access Management Manual, prepared by TRB. A high number of access points increases the number of vehicle-conflicts, which increases the likelihood of vehicle-crashes.
  - Between February 2007 and February 2010 there were a total of 109 crashes along Route 7/20 within the study area, of which two resulted in fatalities.

- There are over 1,100 vehicles per hour (vph) that enter/exit the corridor to/from 60 different unsignalized access points during the Saturday midday; during the weekday evening peak hour this total is almost 1,000 vph.

- A significant number of crashes have been observed within the vicinity of West Mountain Road. A total of 12 crashes, including one fatal, have been reported over the three year period.
  - Of the 12 crashes reported in this area, at least 5 were pedestrian-related. These include one crash where a pedestrian was struck and a fatally occurred. Four others incidents were when vehicles struck another vehicle that had stopped to allow a pedestrian to cross Route 7/20 within the unsignalized crosswalk just north of Arizona Pizza.

- Trucks delivering to Guido's have been observed to pull into Route 7/20, blocking traffic, prior to backing into the loading docks.

- There were two fatalities along the corridor at the following locations:
  - Pedestrian fatality near Haddad Motors, pedestrian crossing the corridor very early morning and at a non-marked crossing; and
  - Pedestrian fatality near West Mountain Road, pedestrian crossing the corridor at the existing mid-block crossing.

- The existing shoulder width along this section of Route 7/20 is approximately two feet wide, which does not meet current design standards for a principal arterial roadway that is on the National Highway System (NHS).

- Turning left from the driveways between the Center at Lenox and Dan Fox Drive has been observed to be very difficult and unsafe. Approximately 64-percent of all turning movements to/from unsignalized driveways occur between these two intersections.

- Based on gap acceptance data collected at unsignalized driveways along the corridor, it was determined that the critical gap for left-turning vehicles is approximately 4.5 seconds, while the critical gap for right-turning vehicles is 4.8 seconds. Since the analysis for unsignalized intersections defaults at between 6 and 7.5 seconds, this data suggests that drivers must act aggressively to exit unsignalized driveways along the corridor. These drivers also use the TWLTL to accelerate and merge onto Route 7/20.

3

Land Use and Development Regulations

This Chapter presents the findings of the land use analysis for the 7/20 Corridor, including existing zoning designations and the forecasted future development/redevelopment opportunities of the parcels along the corridor.

A transportation system exists in part to serve and provide access to adjacent land uses, which in turn generate traffic demands which dictate the design and layout of a transportation system. This interconnectivity between transportation and land use has long been documented as a fundamental relationship that must be considered for a comprehensive transportation and land use planning effort. It was noted in previous chapters that the Route 7/20 study area corridor is a Principal Arterial, which based on this classification alone is a roadway that should primarily provide regional mobility. Lack of coordination between vehicular access and land use has often led to safety issues (crashes), an increase in vehicle miles traveled, congestion, and air pollution.

Existing and potential land uses are critically important factors to consider during the investigation of corridor access enhancements. The types of uses, their peak use times, whether they are daily, weekly, weekends or seasonal, all impact traffic flow and access along the corridor. Therefore, it is important to understand existing and anticipated future land use patterns to understand existing traffic patterns and how they may change over time.

3.1 Existing Land Use

An initial documentation of Land Use classifications was summarized from a variety of existing sources including the Massachusetts Geographic Information System (MassGIS), Berkshire Regional Planning Commission and the City of Pittsfield GIS database. VHB then field checked each parcel and building to document existing land uses as well as occupancy. This land use inventory included all parcels that abut the Route 7/20 corridor as well as those parcels that are developed or may be developed with access from Route 7/20.

A summary of the parcels, their size, zoning, address and land uses are summarized in Tables 3-1 and 3-2 below and illustrated in Figures 3-1 and 3-2. The following provides an overview of the existing land uses along the study area corridor:

- There are a 52 total parcels along corridor, which consist of:
  - 36 parcels in the Town of Lenox.
  - 16 parcels in the City of Pittsfield.
  - 4 parcels not having direct access (curb cut) to Route 7/20.
  - Parcels that have direct access to Route 7/20 have an average of 1.25 curb cuts.
- Existing land uses along the corridor consists of the following:
  - Residential type uses account for approximately 6 percent of all parcels.
  - Restaurant type uses account for approximately 13 percent of all parcels.
  - Motels/hotel type uses account for approximately 17 percent of all parcels.
  - Commercial/retail type uses account for approximately 46 percent of all parcels.
  - The remaining parcels, or approximately 18 percent, account for the following: office, conservation, municipal land, Commonwealth land, vacant property or utility uses.

File source: \\Maworc\projects\11140.00\GIS\project\RT7_20-FIG4-1.mxd

PARCEL	STREET #	STREET	EXISTING USE	PROPERTY DESCRIPTION	ZONE	RT 7/20 CURB CUTS
-	-	7/20 @ NEW LENOX RD	ROADWAY	INTERSECTION	-	1
27-51-0	355	PITTSFIELD RD	RESTAURANT	5 CHAIR RESTAURANT	C-3A	1
27-52-0	359	PITTSFIELD RD	COMMERCIAL	CAR WASH	C-3A	0*
27-53-0	0	PITTSFIELD RD	COMMERCIAL	CAR WASH	C-3A	0*
27-54-0	365	PITTSFIELD RD	RESTAURANT	LU AU HALE RESTAURANT	C-3A	2
-	-	7/20 @ WEST MOUNTAIN RD	ROADWAY	INTERSECTION	-	1
27-69 1-1-0	0	ROLLING HILLS CONDO	RESIDENTIAL	ROLLING HILLS CONDOS	C-3A	NA
28-34-0	405	PITTSFIELD RD	RESIDENTIAL	MOBILE HOMES	C-1A	1
33-1-0	439	PITTSFIELD RD	COMMERCIAL	ESSENTL. SALON / FOR LEASE	C-1A	1
33-1-1	445	PITTSFIELD RD	MOTELS	HAMPTON INN ACCESS	C-1A	1*
33-2-0	449	PITTSFIELD RD	OFFICE	LENOX PROF. BLDG.	C-1A	0*
49-11-0	385	PITTSFIELD RD	VACANT		C-3A	0
49-13-0	395	PITTSFIELD RD	RESTAURANT	ARIZONA PIZZA	C-1A	1
49-14-0	399	PITTSFIELD RD	MUNI.,DISTRICTS	LENOX FIRE DPET.	C-1A	1

* SHARED DRIVEWAY WITH AN ADJACENT PARCEL
NA: NO DIRECT ACCESS TO CORRIDOR

PARCEL	STREET #	STREET	EXISTING USE	PROPERTY DESCRIPTION	ZONE	RT 7/20 CURB CUTS
49-15-0	4	HOLMES RD	COMMERCIAL	DONNOVAN MOTOCAR SRVC.	C-3A	NA
49-16-0	0	PITTSFIELD RD	COMM. OF MASS.		R-1A	0
49-17-0	392	PITTSFIELD RD	COMMERCIAL	CULLIGAN WATER SYTEMS	C-3A	2
49-18-0	388	PITTSFIELD RD	RESIDENTIAL	SINGLE FAMILY	C-1A	1
49-19-0	384	PITTSFIELD RD	RES./COM.		C-1A	1
49-20-0	374	PITTSFIELD RD	COMMERCIAL	DIF. DRUM. KITCH. /COOKS RSRC.	C-1A	2
50-1-0	461	PITTSFIELD RD	MOTELS	THE YANKEE	C-1A	2
50-10-0	462	PITTSFIELD RD	MOTELS	HOWARD JOHNSON	C-1A	1
50-11-0	450	PITTSFIELD RD	COMMERCIAL	SUBWAY / BRKSHR. LTNG. / LENOX INT. MED.	C-1A	1
50-12-0	444	PITTSFIELD RD	COMMERCIAL	HOLMES LQR. /FMLY. FOOTWR.	C-1A	1
50-14-0	2	HOLMES RD	BANKS		C-1A	NA
50-15-0	426	PITTSFIELD RD	COMMERCIAL	MOBILE GAS	C-1A	2
-	-	7/20 @ HOLMES RD	ROADWAY	INTERSECTION	-	1

Source Mass GIS, Berkshire County, Town of Lenox, City of Pittsfield

Legend

Town Boundaries
Lenox Parcels
Road
Lenox Zoning Line
Bus Stops

Land Use

Open
Commercial
Residential
Industrial and Mining
Institutional and Recreational
Powerline/Utility; Transitional; Transportation
Waste Disposal
Water

Curb Cut Volumes

< 10
11 - 30
31 - 60
61 - 90
91 >

0 90 180 Feet

Vanasse Hangen Brustlin, Inc.

FIGURE 3-1

Existing Land Use Summary
Sheet 1 of 2

Route 7/20 Corridor
Access Management Plan

File source: \\Maworc\projects\11140.00\GIS\project\RT7_20-FIG4-2.mxd

PARCEL	STREET #	STREET	EXISTING USE	PROPERTY DESCRIPTION	ZONE	RT 7/20 CURB CUTS
33-4-0	489	PITTSFIELD RD	RETAIL / COMMERCIAL	THE LENOX SHOPPING CNTR	C-1A	2
33-5-0	515	PITTSFIELD RD	COMMERCIAL	NORTH'S (AUTO REPAIR)	C-1A	2
33-6-0	525	PITTSFIELD RD	MOTELS	LENOX INN	C-1A	1
33-7-0	526	PITTSFIELD RD	COMMERCIAL	TOYOTA / HYUNDAI	R-1A	2
33-8-0	514	PITTSFIELD RD	RETAIL	MONROE MUFFLER	C-1A	1
33-9-0	506	PITTSFIELD RD	RESTAURANT	PANDA HOUSE	C-1A	1
33-11-0		PITTSFIELD RD	REST / RETAIL	BURGER KING / LAUNDROMA	C-1A	2
50-5-0	475	PITTSFIELD RD	RETAIL	YANKEE CANDLE	C-1A	2
50-31-0	0	PITTSFIELD RD	MUNI.,DISTRICTS	HOLMESWOOD TERRACE	C-1A	1
50-7-0	490	PITTSFIELD RD	RESTAURANT	HALPINS RESTAURANT	C-1A	1
50-8-0	484	PITTSFIELD RD	MOTELS	WAGON WHEEL MOTEL	C-1A	2
50-9-0	474	PITTSFIELD RD	MOTELS	THE KNIGHTS INN	C-1A	2

PARCEL	STREET #	STREET	EXISTING USE	PROPERTY DESCRIPTION	ZONE	RT 7/20 CURB CUTS
H-01-1-1	1	DAN FOX DR	RETAIL / COMMERCIAL	STOP & SHOP SUPERCENTER	L-D-I	NA
H-01-1-101		DAN FOX DR			B-G	NA
H-01-1-104	1046	SOUTH STREET	COMMERCIAL	CAR WASH	B-G	0*
H01-1-108	1020	SOUTH STREET	RETAIL	GUIDO'S FOOD MART	B-G	1*
H01-1-3	1030	SOUTH STREET	COMMERCIAL	BP GAS	B-G	1*
H01-1-6	1030	SOUTH STREET	RETAIL	GARDEN CENTER	B-G	1
H01-1-4	1046	SOUTH STREET	COMMERCIAL	JIFFY LUBE / DOG GROOMING	B-G	2*
H01-1-5		SOUTH STREET	HOTEL	LENOX INN	B-G	1
H01-1-7	1032	SOUTH STREET	MANUFACTURING	PITTSFIELD RYE CO.	B-G	1*
H01-2-1	1055	SOUTH STREET	HOTEL	COMFORT INN	B-G	1
H01-2-2	1055	SOUTH STREET	UTILITY	FENCED OFF	B-G	0
H01-2-5	1045	SOUTH STREET			B-G	2
H01-2-3	1035	SOUTH STREET	RESTAURANT	DAKOTA RESTAURANT	B-G	2
H01-2-4	1025	SOUTH STREET	COMMERCIAL	SHELL / DUNKIN DONUTS	B-G	2
H01-2-5	1021	SOUTH STREET	RETAIL	AMAZING	B-G	2
H01-2-6		SOUTH STREET	VACANT	CONSERVATION	B-G	1
H01-2-7		SOUTH STREET			B-G	1
H02-1-401	8	SOUTH STREET	HOTEL	PATRIOT SUITES	B-G	0
H01-2-405		SOUTH STREET			B-G	0
-	-	7/20 @ DAN FOX DR	ROADWAY	INTERSECTION	-	1

* SHARED DRIVEWAY WITH AN ADJACENT PARCEL

NA: NO DIRECT ACCESS TO CORRIDOR

Source Mass GIS, Berkshire County, Town of Lenox, City of Pittsfield

Legend

- Town Boundaries
- Lenox Parcels
- Road
- Lenox Zoning Line
- Bus Stops

Land Use

- Open
- Commercial
- Residential
- Industrial and Mining
- Institutional and Recreational
- Powerline/Utility; Transitional; Transportation
- Waste Disposal
- Water

Curb Cut Volumes

- < 10
- 11 - 30
- 31 - 60
- 61 - 90
- 91 >

0 90 180 Feet

Vanasse Hangen Brustlin, Inc.

FIGURE 3-2

Existing Land Use Summary
Sheet 2 of 2

Route 7/20 Corridor
Access Management Plan

Table 3-1
Parcel Inventory along Corridor – Town of Lenox

Parcel	Street #	Street	Existing Use	Property Description	Zone	Area (acres)	Redevelopment Potential
27-51-0	355	Pittsfield Rd	Restaurant	5 Chair Restaurant	C-3A	1.1	High
27-52-0	359	Pittsfield Rd	Commercial	Car Wash	C-3A	0.5	High
27-53-0	0	Pittsfield Rd	Commercial	Car Wash	C-3A	0.8	High
27-54-0	365	Pittsfield Rd	Restaurant	Lu Au Hale Restaurant	C-3A	1.6	Med
27-69	0	Rolling Hills Condo	Residential	Rolling Hills Condos	C-3A	51.9	Low
28-34-0	405	Pittsfield Rd	Residential	Mobile Homes	C-1A	9.5	Low
33-1-0	439	Pittsfield Rd	Commercial	Essentl. Salon / For Lease	C-1A	125.8	Low
33-1-1	445	Pittsfield Rd	Motels	Hampton Inn Access	C-1A	6.4	Low
33-2-0	449	Pittsfield Rd	Office	Lenox Prof. Bldg.	C-1A	0.6	Low
49-11-0	385	Pittsfield Rd	Vacant		C-3A	1.0	High
49-13-0	395	Pittsfield Rd	Restaurant	Arizona Pizza	C-1A	0.5	Low
49-14-0	399	Pittsfield Rd	Municipal	Lenox Fire Dept.	C-1A	0.5	Low
49-15-0	4	Holmes Rd	Commercial	Donnovan Motocar Srvc.	C-3A	1.7	Low
49-16-0	0	Pittsfield Rd	Comm. Of Mass.		R-1A	8.4	NA
49-17-0	392	Pittsfield Rd	Commercial	Culligan Water Systems	C-3A	1.8	Low
49-18-0	388	Pittsfield Rd	Residential	Single Family	C-1A	0.3	High
49-19-0	384	Pittsfield Rd	Res./Com.		C-1A	3.2	High
49-20-0	374	Pittsfield Rd	Commercial	Dif. Drum. Kitch. /Cooks Rsrc.	C-1A	0.5	Low
50-1-0	461	Pittsfield Rd	Motels	The Yankee	C-1A	6.9	Low
50-10-0	462	Pittsfield Rd	Motels	Howard Johnson	C-1A	2.9	Med
50-11-0	450	Pittsfield Rd	Commercial	Subway / Brkshr. Ltng. / Lenox Int. Med.	C-1A	1.1	Low
50-12-0	444	Pittsfield Rd	Commercial	Holmes Lqr. /Fmly. Footwr.	C-1A	0.8	Low
50-14-0	2	Holmes Rd	Commercial	Bank	C-1A	0.7	Low
50-15-0	426	Pittsfield Rd	Commercial	Mobile Gas	C-1A	0.2	Low
33-4-0	489	Pittsfield Rd	Retail / Commercial	The Lenox Shopping Center	C-1A	35.7	Low*
33-5-0	515	Pittsfield Rd	Commercial	North's (Auto Repair)	C-1A	1.0	High
33-6-0	525	Pittsfield Rd	Motels	Lenox Inn	C-1A	2.1	Med
33-7-0	526	Pittsfield Rd	Commercial	Toyota / Hyundai	R-1A	5.5	Med
33-8-0	514	Pittsfield Rd	Retail	Monroe Muffler	C-1A	1.7	Low
33-9-0	506	Pittsfield Rd	Restaurant	Panda House	C-1A	0.6	Low
33-11-0		Pittsfield Rd	Rest / Retail	Burger King / Laundromat	C-1A	2.0	Low
50-5-0	475	Pittsfield Rd	Retail	Yankee Candle	C-1A	0.7	Low
50-31-0	0	Pittsfield Rd	Muni.,Districts	Holmeswood Terrace	C-1A	0.1	Low
50-7-0	490	Pittsfield Rd	Restaurant	Halpins Restaurant	C-1A	0.6	Low
50-8-0	484	Pittsfield Rd	Motels	Wagon Wheel Motel	C-1A	1.0	Med
50-9-0	474	Pittsfield Rd	Motels	The Knights Inn	C-1A	1.5	Med

* This parcel was currently being redeveloped at the time that this study was being prepared.

Table 3-2
Parcel Inventory along Corridor – City of Pittsfield

Parcel	Street #	Street	Existing Use	Property Description	Zone	Area (acres)	Redevelopment Potential
H-01-1-1	1	Dan Fox Dr	Retail / Commercial	Stop & Shop Supercenter	L-D-I	12.8	Low
H-01-1-101		Dan Fox Dr			B-G		NA
H-01-1-104	1046	South Street	Commercial	Car Wash	B-G	0.3	Low
H01-1-108	1020	South Street	Retail	Guido's Food Mart	B-G	1.4	Med
H01-1-3	1030	South Street	Commercial	BP Gas	B-G	0.6	Low
H01-1-6/7	1030	South Street	Retail	Garden Center	B-G	3.0	High
H01-1-4	1046	South Street	Commercial	Jiffy Lube / Dog Grooming	B-G	0.6	Low
H01-1-5		South Street	Hotel	Lenox Inn	B-G	0.4	Low
H01-1-102	1032	South Street	Manufacturing	Pittsfield Rye Co.	B-G	15.7	Med
H01-2-1	1055	South Street	Hotel	Comfort Inn	B-G	1.8	Low
H01-2-2	1055	South Street	Utility	Fenced Off	B-G	0.1	Low
H01-2-3	1035	South Street	Restaurant	Dakota Restaurant	B-G	2.2	Low
H01-2-4	1025	South Street	Commercial	Shell / Dunkin Donuts	B-G	1.1	Low
H01-2-5	1021	South Street	Retail	Amazing	B-G	0.4	Low
H01-2-6		South Street	Vacant	Conservation	B-G	33.0	Med
H02-1-401	8	South Street	Hotel	Patriot Suites	B-G	17.1	Low

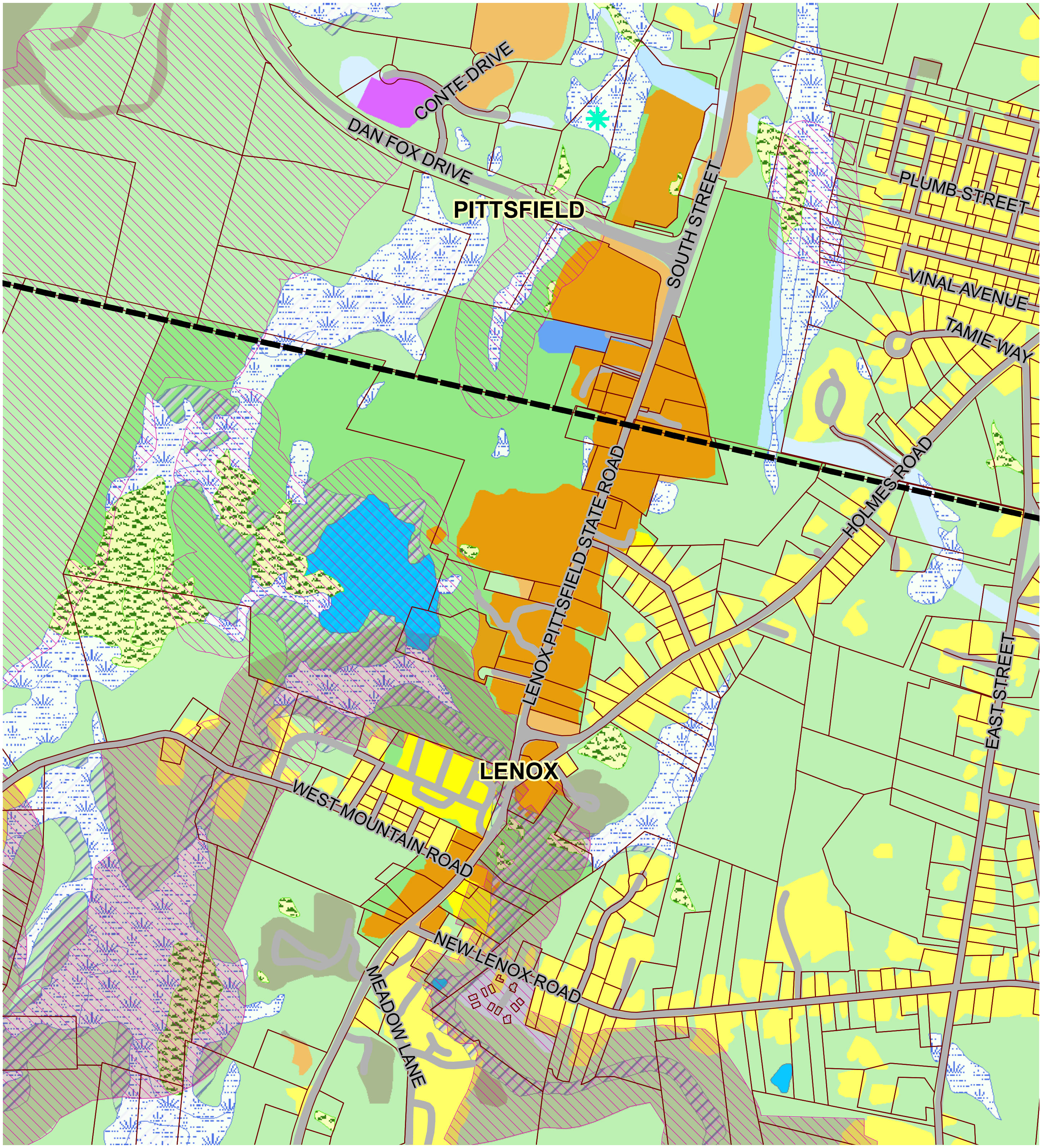
* This parcel was currently being redeveloped at the time that this study was being prepared.

After identifying the type of uses along the corridor, it is important to note the amount of acreage that makes up the corridor. Therefore, Table 3-2 below summarizes (by category) the various land uses along the corridor by acreage. Figure 3-3 illustrates these areas.

To summarize Table 3-2, the predominant active land use along the corridor is commercial (75.2 acres, 23.5 % of the total land area). This land use includes mixed use developments with a variety of small strip retail, fast-food restaurants, gas stations, and/or other services. Other active land uses consist of the following:

- Power line/utility uses (5.5 acres, 1.7 %), residential uses (11 acres, 3.4 %) and industrial uses (2.6 acres, 0.8 %).
- The largest overall land use categorization by the MassGIS land use data is the open space category (211.3 acres, 66.6 %) which includes forested areas, Priority Habitats of Rare Species, Estimated Habitats of Rare Wildlife and wetlands.
- Open water (14.7 acres, 4.6 %) can also be added to the category of open space.

File source: \\Maworc\projects\11140.00\GIS\project\RT7_20-FIG1.mxd



Source: Mass GIS, Berkshire County, Town of Lenox, City of Pittsfield

Legend

Parcel Boundaries

Landuse2005

- Open
- Commercial
- Residential
- Industrial and Mining
- Institutional and Recreational
- Powerline/Utility; Transitional; Transportation
- Waste Disposal
- Water

Certified Vernal Pools 2009

Priority Habitats of Rare Species 2008

Estimated Habitats of Rare Wildlife 2008

0 500 1,000 Feet

Vanasse Hangen Brustlin, Inc.

Existing Conditions

Figure 3-3

Route 7/20 Corridor
Access Management Plan

It must be highlighted that much of the open space designation does not represent available developable land, since the majority of the open space lands are sensitive environmental areas that cannot be altered or are lands that have conservation restrictions. However, there are some parcels with forested land that can be developed, and those parcels are included in the listing of parcels with "high" redevelopment potential which is also summarized in Tables 3-1 and 3-2; more details on the redevelopment potential can be found later in this chapter.

Table 3-3
Route 7/20 Corridor Land Use Summary

Land Use Type	Acres (Approx.)	Percent of Total (Approx.)
Commercial	75.2	23.5%
Industrial	2.6	0.8%
Open [1]	211.3	66.0%
Powerline/Utility; Transitional; Transportation	5.5	1.7%
Residential [2]	11.0	3.4%
Water	14.7	4.6%
TOTAL:	**320.26**	**100.0%**

Source Data: MassGIS (refer to Figure 2-1). Land use designations are based on MassGIS orthophoto and visual interpretation; in the spring of 2010 as such, land uses are not necessarily reflective of existing parcel development.

1. Includes: Cropland, Forest, Forested Wetland, Open Land, Pasture, Nonforested Wetland,
2. Includes: High, Medium, Low, Very Low and Multi-Family Residential

3.2 Existing Regulations

The 7/20 Corridor study area overlaps two communities with the Lenox portion of the corridor zoned C 1A – Commercial, and the Pittsfield portion zoned General Business District and L-D-I Limited Industrial; see Zoning Figure 3-4. However, Pittsfield's Limited Industrial zone only applies to a small portion of the study area. In addition, the corridor is under the jurisdiction of MassDOT Highway Division, and as such State Regulations are applicable to the corridor. The following is a zoning summary for the major zones in each community, of which overlap with the study area for this action plan.

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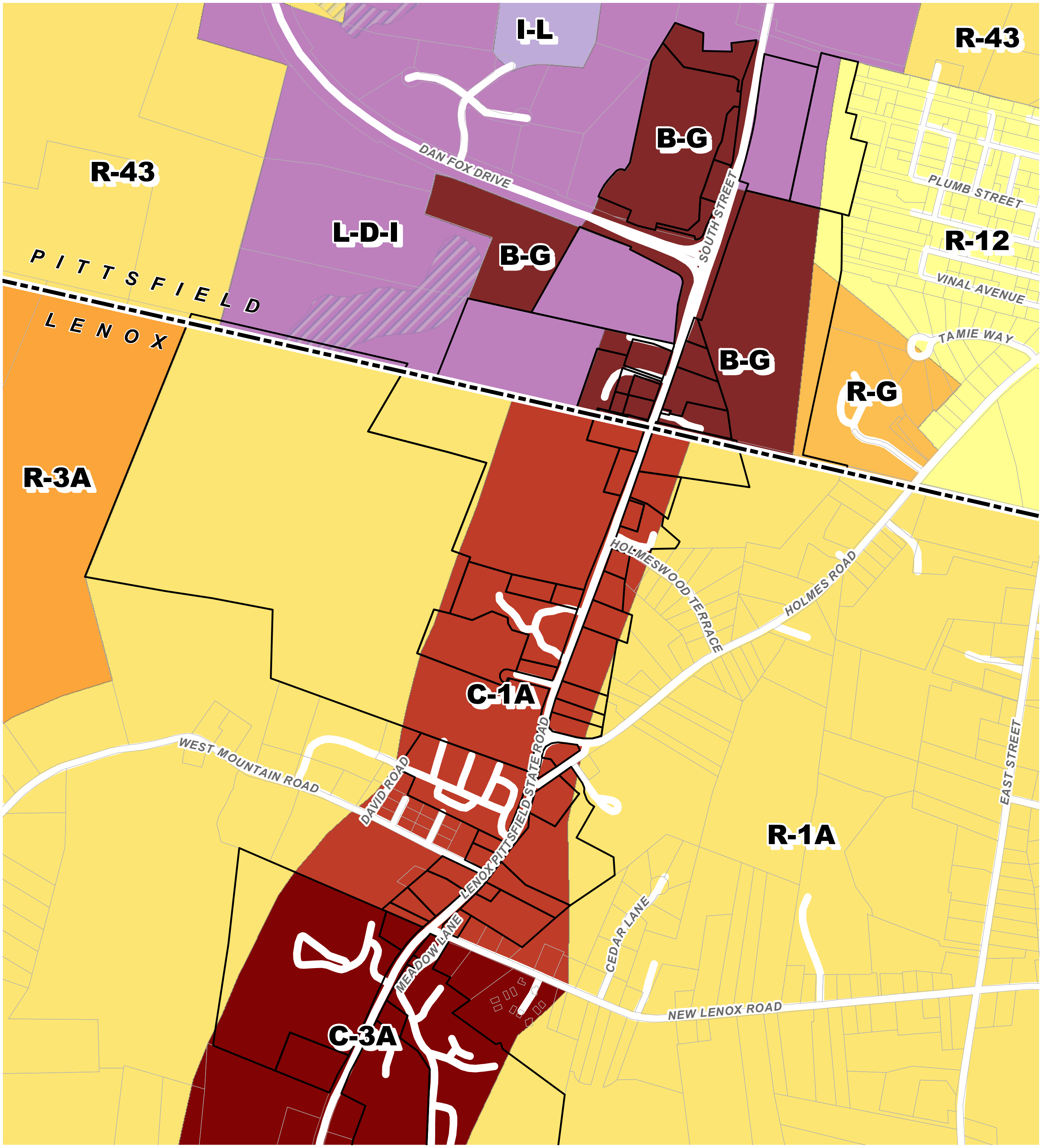


Source: Mass GIS, Berkshire County, Town of Lenox, City of Pittsfield

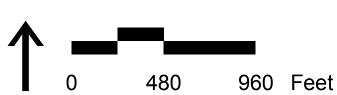
Legend

Town Boundaries

Floodplain District Overlay

Vanasse Hangen Brustlin, Inc.

Existing Zoning — Figure 3-4



Route 7/20 Corridor
Access Management Plan

3.2.1 Town of Lenox Zoning

C-1A Commercial District

- Uses allowed by right or special permit include; Offices (including medical), Laboratory/research, Retail, Restaurant, Manufacture of consumer goods, Personal services, Lumber yards, Vehicle sales and repair.

- Dimensional Regulations:
  - minimum lot size is one acre
  - minimum frontage and lot width is 200′
  - height is limited to 2 stories (35′)
  - setbacks
    1. 50′ for front yard (street line)
    2. 30′ for side yards (lot line)
    3. 35′ for sign setback
    4. 30′ parking area setback (defined as a setback in which there shall be no parking area or intermediate height fencing)

- Parking:
  - *Retail business and consumer service establishment:* 1 space for each 300 square feet of gross floor area
  - *Restaurants, theaters and other places of assembly:* 1 space for each three seats
  - *Offices:* 1 space for each 300 square feet of gross floor area
  - Shared or reduced parking are options

- Site Plan Review:
  - *Drive-through facilities:* site plan review required with a traffic study and mitigation plan; minimum of 200′ between curb cuts and the cut cannot exceed 25′; where feasible, a system of joint use driveways and cross access easements should be established; if service drives are provided between properties, a parking reduction may be allowed; specific standards for stacking lanes.

Traffic Study Requirements

Requirements for traffic studies conducted for projects within the Town of Lenox are governed by the 2009 Zoning Bylaw. The Town's Zoning Bylaw requires a Traffic Impact and Access Study for proposed development within the C-1A or C-3A zoning districts or for fast-food facilities including a drive-through operation. Per Section 9.5 of the 2009 Zoning Bylaw, traffic studies will present the following:

a. *Traffic Flow – Vehicle patterns within the site, egresses and entrances, loading and unloading areas and curb cuts on site and within one hundred feet of the site.*

b. *Trip Generation – The projected number of motor vehicle trips to enter or depart from the site shall be estimated for daily hour and peak hour traffic levels.*

c. *Study Area – A projected traffic flow pattern for both vehicular and pedestrian access shall be described and related to the site plan, including vehicular movement's at all major intersections likely to be affected by the proposed use of the site.*

d. *Traffic Impacts – The impact of this traffic upon existing abutting public and private ways in relation to road capacities. Existing and proposed daily hour and peak hour traffic levels will be given and road capacity levels.*

As a result of the above items, the Zoning Board of Appeals (ZBA) may request a plan to implement improvements needed to provide for the free flow of traffic in areas surrounding the site and identified by the ZBA as impacted by the proposed use.

In addition to Section 9.5, Section 6.12.5 of the 2009 Zoning Bylaw governs the requirements for traffic studies as they relate to uses with drive-through facilities. Section 6.12.5 states the following:

1. *A detailed traffic impact analysis in accordance with professional engineering standards is required for any special permit or site plan approval application containing a drive-through facility for fast food. The SPGA [Special Permit Granting Authority] may require a traffic impact study for other drive-through facilities. A registered professional engineer experienced and qualified in traffic engineering shall prepare the traffic impact study.*

2. *A proposed mitigation plan must be included (with supporting text) to minimize traffic and safety impacts through such means as physical design and layout concepts, or other appropriate means; and an interior traffic and pedestrian circulation plan designed to minimize conflicts and safety problems. Measures shall be proposed to achieve the following post development standards: All streets and intersections to be impacted by the project shall have the same level of service or better than predevelopment conditions. The SPGA must determine that the mitigation is satisfactory.*

3.2.2 City of Pittsfield Zoning

General Business District

- Allowed uses by right or conditional use/special permit: multi-family, assisted living, hotel/motel, galleries, hospital, theater, office/bank/business, automotive sales and service uses, restaurants (with and without drive-thru)/bars, retail, shopping center, laboratories.

- Dimensional regulations: no dimensional regulations that apply other than a 50' height limitation.

- Parking: significant list of requirements for a variety of different uses. Land uses that may be applicable to the corridor include:

  - *Dwellings-Multi-Family*: One and one-half spaces for each dwelling unit.

  - *Dwellings-Garden Apartments*: One and one-half spaces for each dwelling unit.

  - *Eating Establishments (no car or curb service)*: One space for each three seats based on the legal capacity of the facility, plus two spaces for each three employees.

  - *Motels and Hotels*: One space for each guest room, plus two spaces for each three employees.

  - *Offices (Other than Medical or Dental)*: One space for each two hundred (200) square feet of gross floor area.

  - *Offices, Medical, Dental or Allied Professional*: Four spaces for each doctor, or other allied professional person.

- *Stores or Shops, Retail or Service Including but Not Limited to Appliance, Drapery Feed, Floor or Wall Covering, Florist, Furniture, Hardware, Hobby, Interior Decorator, Photographer or Upholstery (Low Generator):* One space for each eight hundred (800) square feet of gross floor area, plus two spaces for each three employees, plus one space for each vehicle used in the operation.

- *Stores or Shops Retail or Service Including But Not Limited to Bakery, Barber, Beauty, Cleaning or Laundry Pickup Stations, Dress, Hat, Jewelry, Paint, or Shoe Repair (Medium Generator):* One space for each three hundred (300) square feet of gross floor area, plus two spaces for each three employees, plus one space for each vehicle used in the operation.

- *Stores or Shops Retail or Service Including But Not Limited to Automobile Accessories, Department Stores, Drug, Food, Laundry (Coin Operated), or Variety (High Generator):* Two spaces for each three hundred (300) square feet of gross floor area, plus two spaces for each three employees, plus one space for each vehicle used in the operation.

➢ <u>Site Plan Review:</u> Site Plan Review requirements apply to uses listed in the use table as being conditional uses subject to special requirements and those that require a special permit. These include:

  - *Multi-family housing:* pedestrian and vehicular internal circulation should meet applicable safety standards. Buildings with 40 or more units must have two access ways; buildings with less than 40 units require a 16′ driveway or two separate driveways. Open space needs to be provided (100 sq. ft. per bedroom, in addition to meeting applicable setbacks).

  - *Hospitals:* requires that the driveway be at least 40′ from the lot line; the front yard should be landscaped; and that internal vehicular circulation should meet applicable safety standards.

  - *Auto service stations:* no driveway should be wider than 25′ or closer to 30′ from an intersection.

  - *Shopping centers:* a circulation system should be designed for all modes of transportation with clearly defined circulation routes; an impact statement is required, which includes a traffic assessment; vehicular and pedestrian traffic is one of the special permit criteria.

- *Drive-through restaurants:* movement of traffic should not cause any obstructions; drive-through areas should be landscaped; traffic study required; traffic control may be required if stacking lanes back up onto the street

Traffic Study Requirements

The City of Pittsfield Zoning Ordinance provides requirements for the permitting of all proposed uses within the City. Analyses of traffic impacts are required for all conditional uses (i.e. all uses which the City deems the need for Special Requirements or a Special Permit). Section 7.4 of Article 23-7 in the City of Pittsfield Zoning Ordinance states:

Any conditional use shall be located with relation to major thoroughfares and uses in the neighborhood as not to create traffic hazards or congestion.

This requirement puts the onus on whichever City department or board to determine a proposed project's area of impact, with limited guidance. Projects falling within specific overlay districts may have additional regulations; however the onus still falls on the City to determine a project's area of impact.

3.2.3 State Review Procedures

This section serves as a brief explanation to the existing Commonwealth of Massachusetts project review procedures in place for new and/or redevelopment Projects that meet certain review thresholds and that either directly abut or access Route 7/20.

The Commonwealth of Massachusetts (i.e., the "state") has in place specific Project evaluation criteria that may require review by any number of state agencies. For many land development projects, state environmental review agencies include the Massachusetts Department of Environmental Protection (MassDEP) for environmental subject matter involving wetland resource areas; wet infrastructure (i.e., water, wastewater, storm water management); oil and hazardous materials; air quality; and others. For land development projects that are likely to result in a specified volume of additional traffic generation and that either abut or require access from a state highway layout (such as Route 7/20), MassDOT requires the issuance of a State Highway Access Permit (MGL 720 CMR 13.00).

In addition to MassDEP and MassDOT, a land development project may require state environmental review for a number of potential Project impacts and/or required mitigation. These Project review thresholds are most commonly associated with the Massachusetts Environmental Policy Act (MEPA) state environmental review process. MEPA is an umbrella review process that is required for Projects of certain size, environmental impact, or Commonwealth land transfer or Commonwealth funding.

More details on the MEPA and MassDOT process and the review thresholds most commonly triggered for land development projects abutting a state jurisdictional roadway can be found in the Appendix.

3.3 Future Land Use

One component of forecasting future traffic volumes within the study area is to identify the development or redevelopment potential of the parcels along the corridor. In the case of this 7/20 Corridor study, "redevelopment" is the more applicable term since all parcels that can be developed have some level of development already on them. Therefore the term redevelopment is applicable to describe expansion or a change in parcel use or expansion of building square footage to support existing or new uses. There are a few parcels that are undeveloped, but this is mainly due to environmental restrictions that will not allow future development.

3.3.1 Potential Redevelopment Ranking

For this study, VHB met with municipal officials to discuss the redevelopment potential of each parcel along the corridor. Parcels were ranked as having either "high", "medium" or "low" potential for redevelopment. Table 3-1 above summarizes the redevelopment potential for the corridor. The following summarizes the characteristics of a parcel that has a high, medium or low redevelopment potential.

Those parcels ranked as having a "high" redevelopment potential are mainly:

- Parcels with undeveloped land that has minimal or no environmental restrictions that can support new uses, such as the Pittsfield Rye Bread Company.
- Parcels that are on the market, vacant or greatly underutilized, such as the Garden Center in Pittsfield and residential parcels in Lenox.

- Adjacent parcels under common ownership could be combined into one parcel, and then redeveloped for a new use.

- Approximately 17 percent of the parcels along the study area corridor have a "high" potential for redevelopment.

Those parcels ranked as having a "medium" redevelopment potential are mainly:

- Parcels with uses that are likely to change or be upgraded, such as some of the old motel sites.

- Businesses where some limited expansion is anticipated, such as Guido's market and the Toyota/Hyundai dealership.

- Approximately 17 percent of the parcels along the study area corridor have a "medium" potential for redevelopment.

Those parcels ranked as having a "low" redevelopment potential are mainly:

- Small parcels that are built out are not likely to change; this includes parcels with restaurants or parcels that have been recently redeveloped, like the Hampton Inn.

- Parcels with environmental restrictions that will not allow expansion onto un-built portions of the parcel.

- Parcels with a dedicated use, such as a utility corridor, that is unlikely to change.

- Approximately 66 percent of the parcels along the study area corridor have a "low" potential for redevelopment.

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4

Future Traffic Conditions

This Chapter provides an assessment of the future traffic conditions at the five key intersections identified in previous chapters for the Route 7/20 Corridor study area. Sections of this chapter present discussions on future traffic growth, which includes potential redevelopments and future traffic operations. Key findings from this chapter include:

- Traffic volumes in the regional have been holding constant over the last 3 to 4 years, and in some cases have been decreasing.
- To account for future growth, and provide a conservative assessment, a 1% per year (for ten years) historical traffic growth was used to project existing traffic volumes to a future ten year planning horizon (2020).
- The only known redevelopment project that is expected to significantly impact the study area is the Center at Lenox expansion. Traffic volumes associated with this redevelopment have been included in this future assessment.
- All signalized intersections within the study area are expected to operate at an overall Level of Service (LOS) "C" or better.
- Turning movements from West Mountain Road onto Route 7/20 are expected to operate at a Level of Service (LOS) D and F during the weekday evening and Saturday midday peak hour, respectively.

4.1 Traffic Forecasts

Traffic volumes in the study area were projected to the year 2020, which reflects a ten-year traffic-planning horizon. Volumes on the roadway network for the year 2020 condition were assumed to include existing traffic, general traffic growth for the area, and new traffic expected to use the corridor as a result of planned background developments (or redevelopments).

Historic traffic growth on area roadways is a function of the expected land development, economic activity, and changes in demographics. Several methods can be used to estimate this growth. A procedure frequently employed is to estimate an annual percentage increase and apply that increase to study area traffic volumes. An alternative procedure is to identify estimated traffic generated by planned new major developments that would be expected to impact the project's study area roadways;

this is known as a background project. Typically these projects are planned to occur within the study year period, which in this case is a ten-year horizon forecasting to 2020.

For the purpose of this assessment, and to provide a conservative assessment, both the traffic growth and background projects methodologies were used. These two methodologies were added to the 2010 Existing traffic volume networks to reflect the year 2020 Future traffic conditions within the project study area. More details on the methodology used for each is described below.

4.1.1 Historical Traffic Growth

Regional traffic growth is projected by examining historical traffic growth along the Route 7/20 corridor. MassDOT count data was reviewed to predict a rate at which traffic volumes are or can be expected to grow. A review of data collected at the MassDOT continuous count Station 40 (located north of Route 7A) suggests that traffic volumes have been holding constant or even decreasing slightly over the past three to four years.

In order to provide a conservative analysis, and because of the redevelopment potential on the study area corridor, and along other areas of Route 7/20, an annual growth rate of one percent (1%) was used. Table 4-1 summarizes the fluctuations in traffic along the corridor for MassDOT permanent count Station 40. This table is the same table that was presented in Chapter 2 (Table 2-3).

Table 4-1
Historical Average Annual Daily Traffic Volumes (AADT)

	Date of Count		Average Annual Traffic Volume		Annual Average Traffic Growth
MassDOT Permanent STA 40	First Count	Last Count	First Count	Last Count	per Year
Route 7/20 – north of Route 7A	2005	2006	24,800	25,500	+ 2.8 %
	2006	2008	25,500	22,250	- 5.0 %
Summary	2005	2008	24,800	22,250	- 2.5 %

Source: MassDOT monthly traffic count data for Route 7/20, located at permanent count station 40 just north of Route 7A.

4.1.2 Background Developments

In addition to accounting for general traffic growth, traffic associated with other planned and/or approved developments along the corridor should be included when generating the future 2020 volume networks. Based on information provided by representatives of the BRPC, Town of Lenox and City of Pittsfield the only planned development at this time, that would be expected to impact the immediate study area, is the expansion of the Center at Lenox.

The Center at Lenox, which has direct access to the corridor via an existing traffic signal located opposite Holmeswood Terrace, is expected to include the construction of an additional 85,269 square feet. With this additional square footage, the site is expected to have a build-out of approximately 191,408 square feet of retail space[5].

For the purposes of this study, traffic volumes estimated by the developer for that project have been included in the future 2020 traffic volume networks. Table 4-2 illustrates the traffic generation that is expected by the Center at Lenox upon completion.

Table 4-2
Background Traffic – Center at Lenox

Time Period	Existing (106,139 SF)	Expansion (85,269 SF)[b]	Total Trips (191,408 SF)
Weekday Daily†	7,050	3,610	10,660
Weekday Evening Peak Hour‡			
Enter	312	163	475
Exit	339	175	514
Total	651	338	989
Saturday Daily†	9,586	4,714	14,300
Saturday Mid-Day Peak Hour‡			
Enter	467	239	706
Exit	432	220	652
Total	899	459	1,358

Note: Site-generated traffic volumes obtained from the Traffic Impact and Access Study prepared by GPI for the proposed Center at Lenox Retail Expansion, dated October 2008.

The year 2020 Future traffic volume networks were developed by applying a one percent annual growth rate over the ten-year study horizon to the existing volume networks and then adding estimated traffic volumes for the Center at Lenox expansion project. Figures 4-1 and 4-2 present the resulting 2020 future peak hour traffic volume networks.

[5] *Proposed Center at Lenox Retail Expansion Project*, Traffic Impact and Access Study by Greenman-Pedersen, Inc., October 2008.

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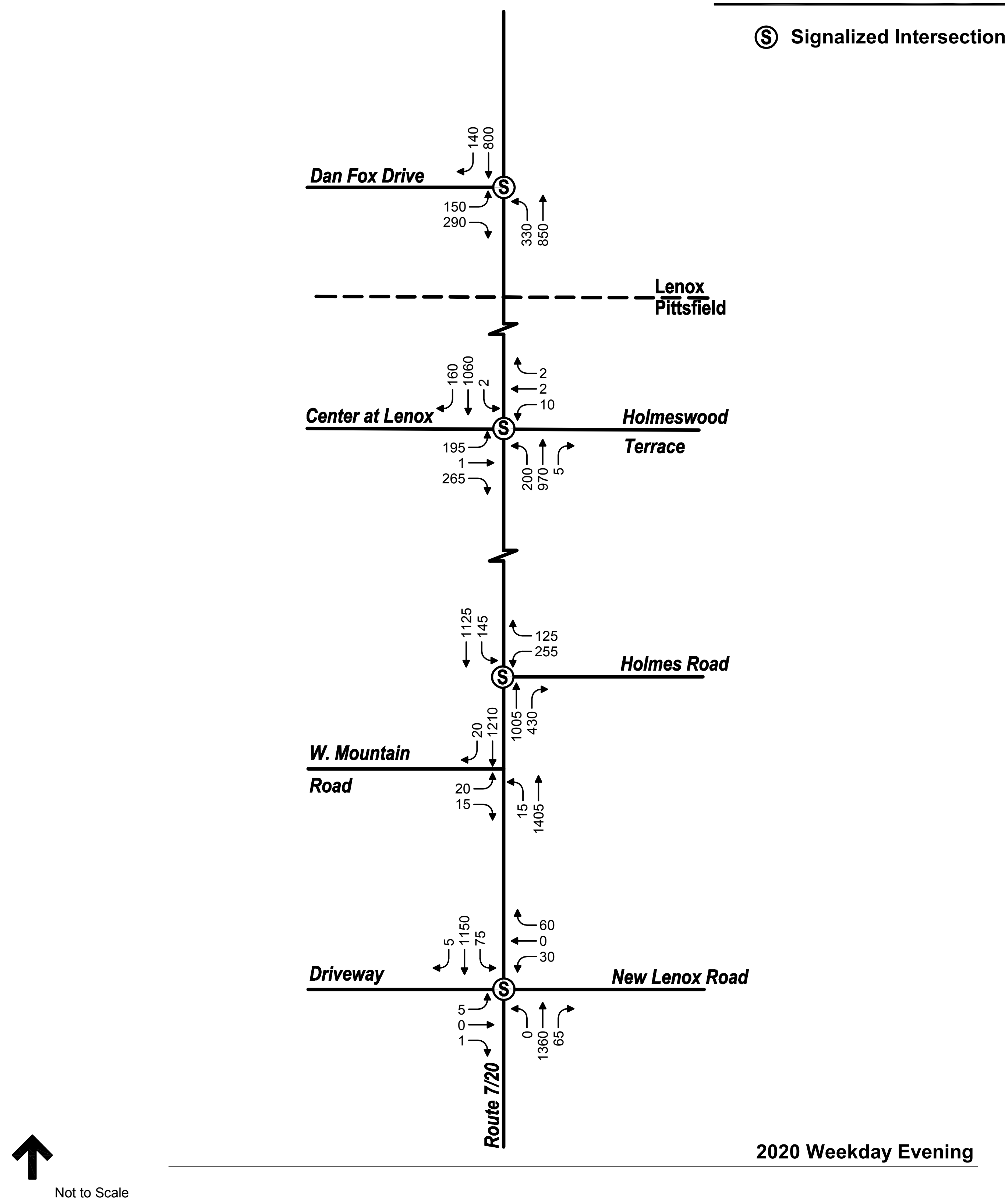
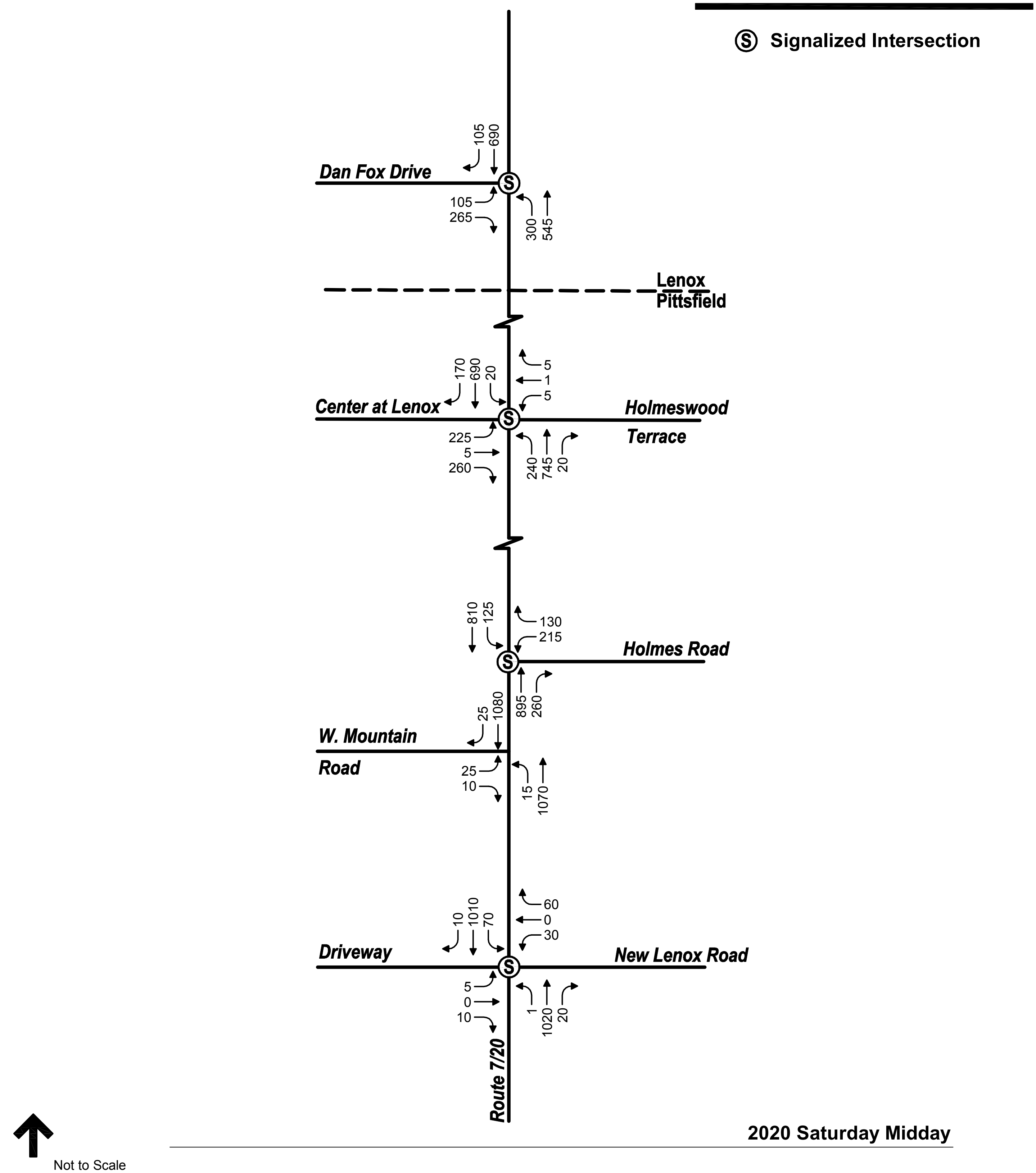


Vanasse Hangen Brustlin, Inc.

2020 Future Peak Hour
Traffic Volumes

Figure 4-1

Route 7/20 Corridor
Access Management Plan



Vanasse Hangen Brustlin, Inc.

2020 Future Peak Hour Traffic Volumes

Figure 4-2

Route 7/20 Corridor Access Management Plan

4.2 Future Traffic Operations Analysis

Measuring existing traffic volumes and projecting future traffic volumes quantifies traffic flow within the study area. To assess quality of flow, roadway capacity analyses were conducted with respect to Existing and projected Future traffic volume conditions. Capacity analyses provide an indication of how well the roadway facilities serve the traffic demands placed upon them. Roadway operating conditions are classified by calculated levels of service. Using the same criteria defined in Chapter 2, which is again summarized in Table 4-3 below, the level-of-service analysis for the future conditions was determined.

Table 4-3
Level of Service Criteria

Level of Service	Signalized Intersection (delay)	Unsignalized Intersection (delay)
A	0 to 10 seconds	0 to 10 seconds
B	10 to 20 seconds	10 to 15 seconds
C	20 to 35 seconds	15 to 25 seconds
D	35 to 55 seconds	25 to 35 seconds
E	55 to 80 seconds	35 to 50 seconds
F	Greater than 80 seconds	Greater than 50 seconds

Source: 2000 Highway Capacity Manual Exhibits 16-2 and 17-2

4.2.1 Signalized Intersections Capacity Analysis

A capacity analysis was conducted for the signalized intersection within the study area under future 2020 traffic conditions. The capacity analysis is summarized in Table 4-4. The Synchro capacity analysis worksheets are located at the end of the Appendix.

Table 4-4
Signalized Intersection Capacity Analysis Summary — 2020 Future Conditions

		Weekday Evening Peak Hour					Saturday Midday Peak Hour				
Intersection	Lane Group	V/C[1]	Delay[2]	LOS[3]	Q (ft)[4]	Q (veh)[5]	V/C	Delay	LOS	Q (ft)	Q (veh)
New Lenox Road and	NB LT	0.00	0.0	A	0	0	0.00	8.4	A	2	1
Five Chairs Restaurant	NB TH	0.85	19.7	B	#348	14	0.63	13.9	B	216	9
	NB RT	0.05	8.7	A	17	1	0.01	8.5	A	10	1
	SB LT	0.17	7.3	A	m12	1	0.15	3.0	A	15	1
	SB TH-RT	0.46	1.7	A	73	3	0.41	1.7	A	68	3
	EB LT-TH-RT	0.10	27.6	C	8	1	0.07	27.6	C	13	1
	WB LT-TH-RT	0.30	28.3	C	45	2	0.29	28.4	C	47	2
	Overall	**0.71**	**12.0**	**B**	**-**		**0.56**	**8.8**	**A**	**-**	**-**
Holmes Road	NB TH	0.59	2.0	A	m18	1	0.49	2.1	A	21	1
	NB RT	0.29	0.3	A	m0	0	0.17	0.2	A	0	1
	SB LT	0.43	10.8	B	m40	2	0.32	4.4	A	31	2
	SB TH	0.50	1.8	A	48	2	0.35	4.0	A	92	4
	WB LT	0.58	26.5	C	81	4	0.50	26.4	C	73	3
	WB RT	0.22	16.0	B	55	3	0.19	16.7	C	51	2
	Overall	**0.60**	**5.0**	**A**	**-**	**-**	**0.49**	**5.7**	**A**	**-**	**-**
Center at Lenox and	NB LT	0.58	8.6	A	33	2	0.52	11.8	B	70	3
Holmeswood Terrace	NB TH-RT	0.44	1.8	A	7	1	0.38	6.9	A	103	4
	SB LT	0.01	5.7	A	m1	1	0.09	12.2	B	18	1
	SB TH	0.64	8.0	A	122	5	0.53	15.3	B	153	6
	SB RT	0.10	3.8	A	m5	1	0.11	11.9	B	32	2
	EB TH-LT	1.23	167.1	F	#206	9	0.89	45.7	D	#181	8
	EB RT	0.22	24.2	C	35	2	0.22	18.5	B	37	2
	WB LT-TH-RT	0.11	23.8	C	17	1	0.02	17.5	B	10	1
	Overall	**0.75**	**20.4**	**C**	**-**	**-**	**0.61**	**15.8**	**B**	**-**	**-**
Dan Fox Drive	NB LT	0.81	26.2	C	m128	6	0.77	20.3	C	m97	4
	NB TH	0.38	2.3	A	m51	3	0.24	2.6	A	m43	2
	SB TH	0.70	21.6	C	#225	9	0.59	18.7	B	193	8
	SB RT	0.09	0.1	A	0	0	0.07	0.1	A	0	0
	EB LT	0.63	29.6	C	#132	6	0.46	26.0	C	87	4
	EB RT	0.41	11.5	B	114	5	0.39	12.0	B	97	4
	Overall	**0.72**	**14.0**	**B**	**-**	**-**	**0.62**	**13.1**	**B**	**-**	**-**

Source: VHB, Inc. using Synchro 7 (Build 763) software.
1 V/C – Volume-to-capacity ratio. V/C ratios range from 1.0 when demand equals capacity to 0 when demand is zero. Values over 1.0 indicate demand in excess of capacity.
2 Delay – Control delay per vehicle, expressed in seconds, includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay.
3 LOS – Level-of-Service. LOS A indicates free flow conditions with minimal delays. LOS E and F indicate congested conditions.
4 Q (ft) – 95th percentile queue length estimate, in feet.
5 Q (veh) – 95th percentile queue length estimate, in number of vehicles, assuming 25 feet per vehicle.
\# 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.
M Volume for 95th percentile queue is metered by upstream signal.
NB = Northbound; SB = Southbound; EB = Eastbound; WB = Westbound; LT = left-turn; TH = through; RT = right-turn; UT = u-turn

Based on the analysis summarized in Table 4-4 above, the signalized intersections within the corridor are expected to continue operating at a good level of service overall. There are specific movements that are expected to degrade over the course of time due to the anticipated increase in traffic. The eastbound through and left-turn movement from the Center at Lenox driveway is expected to worsen in the future without timing or phasing improvements, and is due primarily to the increase in traffic attributed to the redevelopment of the Center at Lenox and the addition of almost 86,000 square feet of retail. This movement is expected to operate at LOS F and LOS D under future weekday evening and Saturday midday conditions respectively. Several other movements are expected to see minor increases in delays and queue lengths consistent with the projected future traffic growth.

4.2.2 Unsignalized Intersection Capacity Analysis

In addition to the signalized intersections, a capacity analysis was conducted for the unsignalized intersection of Route 7/20 and West Mountain Road under Future 2020 traffic conditions. Results of this analysis are provided in Table 4-5. The Synchro capacity analysis worksheets are located at the end of the Appendix.

The analytical methodologies typically used for the analysis of unsignalized intersections use conservative analysis parameters such as high critical gaps. Actual field observations conducted as part of this study indicate that drivers on minor streets and driveways generally accept smaller gaps in traffic than the default values used in the analysis procedures and therefore could experience less delay than reported by the analysis software. Also, the analysis methodologies do not fully take into account the beneficial grouping or platooning effects caused by the nearby signalized intersection. The net effect of these analysis procedures could result in the over-estimation of calculated delays at unsignalized intersections in the study area.

Table 4-5
Unsignalized Intersection Capacity Analysis Summary — 2020 Future Conditions

		Weekday Evening Peak Hour				Saturday Midday Peak Hour			
Intersection	Lane Group	Demand[1]	V/C[2]	Delay[3]	LOS[4]	Demand	V/C	Delay	LOS
West Mountain Road and	NB LT	15	0.03	11.5	B	15	0.03	11.7	B
Route 7/20	EB LT-RT	35	0.23	27.4	D	35	0.46	62.4	F

Source: VHB, Inc. using Synchro 7 (Build 763) software.
1 Demand – Vehicles-per-hour (vph).
2 V/C – Volume-to-capacity ratio. V/C ratios range from 1.0 when demand equals capacity to 0 when demand is zero. Values over 1.0 indicate demand in excess of capacity.
3 Delay – Control delay per vehicle, expressed in seconds, includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay.
4 LOS – Level-of-Service. LOS A indicates free flow conditions with minimal delays. LOS E and F indicate congested conditions.
NB = Northbound; SB = Southbound; EB = Eastbound; WB = Westbound; LT = left-turn; TH = through; RT = right-turn; UT = u-turn

As is shown in Table 4-5, stop-controlled movements to and from West Mountain Road are expected to operate at an acceptable LOS B during the weekday evening peak hour, which is essentially unchanged from existing conditions. However, during the Saturday peak hour, delays are expected to be greater than 60 seconds. Even though the approach is not at capacity (V/C < 1.0), the approach is at a LOS F.

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5

Corridor Access Management

Access management is a useful strategy to preserve the character of a roadway to ensure safe and efficient traffic operations through the management of points of access to adjacent land uses. Land use and transportation planning must be coordinated to ensure that a roadway is accessible, safe, and can provide adequate traffic operations now and in the future. Applying proper access management techniques provides a balance amongst the movement of traffic, access to local land uses, and maintaining the character of the community and the corridor. Poor access management can cause deterioration in traffic operations and safety. In addition, poor planning of land development increases conflicts between adjacent land uses and regional corridor operations.

Successfully applying access management techniques to the Route 7/20 corridor would be challenging in that private infrastructure (parking, signage, utilities, etc.) has been constructed immediately adjacent to the roadway's right-of-way. In addition, applying techniques directly to each parcel would be challenging since most are shallow and the location of existing buildings provides limited opportunities to make adjustments to accommodate access management techniques. As a result, eliminating, consolidating or restricting access for many properties would create internal circulation conflicts, reduce existing parking spaces and limit truck delivery access.

Since there are existing operating deficiencies along the corridor, i.e. crash frequency and the number of access points, access management needs to be retrofitted to the corridor and a plan needs to be established for future redevelopment. This Chapter provides an overview of transportation strategies, land use strategies, and provides a brief summary of techniques used by other agencies. The following is discussed in greater detail:

- A review of the Ten Principles of Access Management and how they compare to the Route 7/20 corridor.
- A summary of access management techniques and the access issues they would address.

- A review of land use regulation strategies which includes a discussion on corridor overlay districts, site plan review, and traffic impact study guidelines.
- A summary of access management practices in the region and country.

5.1 Transportation Strategies

Typically corridors that have been extensively developed may never meet access management standards or requirements. In cases such as these, policies need to be adopted to avoid further degradation of the corridor. In this section, the ten principles of access management will be reviewed and evaluated to the Route 7/20 corridor. Following this evaluation, a set of strategies have been identified that may be applicable to Route 7/20 corridor.

5.1.1 Ten Principles of Access Management

In Chapter 1 an overview of the Ten Principles of Access Management were reviewed. These principles have also been defined and summarized in this section; however, each principle has been compared to the existing characteristics of the corridor. The goal of this effort is to provide the reader with an overview of the issues and challenges with the application of access management techniques to the Route 7/20 corridor.

1. <u>Provide a Specialized Roadway System:</u> Design and manage roadways according to the primary functions they serve.

   <u>Corridor Comparison:</u> The Route 7/20 Corridor is classified as a Principal Arterial Roadway, meaning through traffic mobility is considered a priority. The study area corridor is currently not operating in this manner where there are many access points along the corridor, emphasizing access and not mobility.

2. <u>Limit Direct Access to Major Roadways:</u> Direct property access is more compatible with local and collector roadways.

   <u>Corridor Comparison:</u> As mentioned in bullet 1 above, the Route 7/20 Corridor is a Principal Arterial Roadway promoting regional mobility in the Berkshires. The corridor currently has 60 access points (driveways or intersections) over the one-mile length with more than half present on northern third of the corridor. Most of these access points provide full turning access for vehicles, which creates numerous vehicle conflicts and negatively impacts mobility. Providing direct property access to the corridor encourages the corridor to operate more as a local or collector roadway.

3. Promote Intersection Hierarchy: A functional classification system is important to promote access from one classification of roadway to another.

   Corridor Comparison: Under this principle the following roadway hierarchy would be most desired. Note that definitions have been provided below for each roadway classification. These definitions were obtained from the Access Management Manual prepared by the Transportation Board (TRB) in 2003.

   A. Arterial Roadways: A major roadway intended primarily to serve through traffic, and where access is carefully controlled. This roadway is intended to serve moderate to high volumes of traffic.
   B. Collector Roadways: Road intended to move traffic from local roads to secondary arterials.
   C. Local Roadway: A roadway with the primary function of providing access to adjacent properties and to roadways of a higher functional classification.

   As indicated above, access is most desired from either a collector or local roadway. The lack of these two roadways along the study area corridor limits the ability to reduce vehicle conflict by promoting parcel connections with adjacent streets. As a result, the Route 7/20 corridor has been developed over the years to promote direct access from parcels to an arterial roadway; this does not promote intersection hierarchy.

4. Locate Signals to Favor Through Movements: Poor signal placement may lead to delays and uniform spacing enhances the ability to coordinate traffic signals and ensure continuous movement of traffic.

   Corridor Comparison: The Route 7/20 Corridor currently has four traffic signals, with three of these signals being adequately spaced. The traffic signals of Center at Lenox and Dan Fox Drive are spaced slightly further apart than the desired spacing given the existing corridor characteristics. This may be the reason for the vehicle speeds in this section of the corridor being above the posted speed limit.

5. Preserve the Functional Area of Intersections: Driveway connections too close to intersections can cause conflicts that impair the function of the intersection.

   Corridor Comparison: While the four traffic signals are adequately spaced along the corridor, three have several driveways immediately adjacent to, and within the area of influence of the intersection. The signalized intersection of Dan Fox Drive does not have any driveways that impact the overall operations.

6. Limit the Number of Conflict Points: Limiting the number and type of conflicts between vehicles, vehicles and pedestrians, and vehicles and

bicyclists will reduce the likelihood that drivers will make mistakes and have collisions.

Corridor Comparison: *There are approximately 60 access points (driveways or intersections) over the one-mile corridor, with most of these driveways providing full access for vehicles. The number of access points increases the likelihood of collisions, as more driveways introduce more conflict points. This study has shown that there are areas along the corridor that have a higher than normal number of crashes.*

7. Separate Conflict Areas: Increasing driveway spacing provides drivers with the ability to address one set of potential conflicts before addressing another. As travel speeds increases along a corridor so should the driveway spacing.

   Corridor Comparison: *As a Principal Arterial, the Route 7/20 corridor should have driveways spaced every 530 feet (see the Techniques section below). The entire corridor has an average driveway spacing of less than 200 feet. The average driveway spacing between the signalized intersections of the Center at Lenox and Dan Fox Drive is less than 100 feet. Therefore, the corridor is currently not meeting the requirements of its functional classification.*

8. Remove Turning Vehicles from Through Traffic Lanes: Accommodate left-turns to the extent possible.

   Corridor Comparison: *All key intersections along the Route 7/20 corridor provide designated left-turn lanes. In addition, a two-way left-turn lane (TWLTL) is provided between Holmes Road and Dan Fox Drive. These lanes remove left-turning vehicles from the through traffic lanes. While a TWLTL is provided along the corridor, the efficiency of this lane may be compromised when daily vehicle trips along a corridor reach 24,000 vehicles per day.*

9. Use Raised Medians to Manage Left-Turn Movements: Minimize left turns.

   Corridor Comparison: *A median is currently not present within many areas of the study area corridor. In order to accommodate a raised median, and maintain access to existing businesses, significant widening and relocation of utilities and signs could be needed. In addition, u-turns would need to be provided at critical intersections and have the ability to accommodate large trucks.*

10. Provide a Supporting Street and Circulation System: Well-planned, interconnected, commercial strip development with separate driveways is not desired.

    Corridor Comparison: *The Route 7/20 corridor is currently operating with parcels that access the roadway with individual access, and in most cases parcels have* *multiple access points. This principle creates supporting collector roadway and local streets so that parcels can connect in an interconnected fashion so that shared access driveways and interconnecting driveways can be provided.*

Since the corridor doesn't meet most of these principles, and in many instances parcels are developed up to the roadway with little to no buffer, introducing a "retrofit" program of access control to the Route 7/20 corridor may be difficult as significant right-of-way may be required. Acquiring additional right-of-way to make the necessary improvements could impact adjacent parcels. The following section reviews some of the more common retrofit strategies.

5.1.2 Retrofitting a Corridor

Most retrofit actions limit the number of conflict points, separate conflict areas, and remove turning lanes from the through lanes. The following provides a summary of various retrofit techniques:

- Provide right-turn lanes;
- Provide left-turn lanes;
- Provide two way left turn lane (TWLTL);
- Install a median;
- Close median;
- Install a frontage road;
- Install or modify traffic signals;
- Widen driveways and improve storage area;
- Consolidate driveways;
- Relocate or reorient access;
- Close driveways;
- Redesign internal road and parking system; and
- Replace curb parking with off-street parking.

The characteristics of the Route 7/20 corridor, its numerous adjacent small private parcels and stringent design standards, make it difficult, if not impossible, to implement many of the access management techniques listed above. The following section presents both access management techniques that could implemented to the corridor under current conditions, and if and when parcels are redeveloped.

5.1.3 Access Management Techniques

There are several access management techniques that can be used to organize or minimize traffic movements (or conflicts). This section reviews techniques that could be applied to the corridor so that the capacity of the study area along

Route 7/20 can be preserved and/or enhanced. Some of these techniques can also be applied to manage entering and exiting traffic from land uses more efficiently; however, these techniques cannot be forced upon the owner of the adjacent parcel.

An access management matrix has been prepared that correlates access concerns to access management techniques. This matrix is summarized below and illustrated in Table 5-1.

Table 5-1
Access Management Matrix

	Access Issues									
Access Techniques	*Limit Turning Movement Conflicts*	*Separate Turning Movement Conflicts*	*Auxiliary (Turn) Lanes*	*Left Turns Exiting a Site*	*Left Turns Entering a Site*	*Pedestrian Access/Safety*	*Bicycle Access/Safety*	*Roadway Operations*	*Excessive Driveways*	*Driveway Operations*
Roadway Treatments										
Continuous Two-Way Left-Turn Lane (TWLTL)			X		X			X		
Center Raised Median	X			X	X	X		X	X	X
Shoulder Lane Treatments		X					X	X		
Secondary Roadways										
Frontage/Service Roads	X	X						X	X	
Reverse Frontage Roads	X	X				X		X	X	
Controlled Access										
Traffic Signal Spacing		X		X	X	X	X	X		X
Driveway Design Standards										
Spacing, corner clearances	X	X		X	X	X	X	X	X	X
Joint and Cross Access	X	X		X	X	X	X	X	X	X
Sight Distances		X		X				X		X
Throat Length		X		X	X			X		X
Pedestrian Facilities										
Crosswalk Treatments		X				X	X	X		
New Pedestrian Crossings						X	X	X		
Public Transit										
Bus Stop Location		X				X		X		
Vehicle Guidance										
Restrict Turn Movements	X			X	X	X	X	X		X

In many cases the access management techniques discussed above are unlikely to be applied to the corridor as stand-alone alternatives, and they also may need to be considered as part of land use regulations (overlay district or new zoning). These land use regulations are discussed in the next section.

Roadway Treatments

Roadway treatments can be used to improve safety, access and capacity along a particular segment of roadway or along a corridor as a whole. The following provides a short summary and breakdown of advantages and disadvantages for each treatment. It should be noted that some of these treatments may be currently applied to the study area corridor.

Continuous Two-Way Left Turn Lane (TWLTL)

A continuous TWLTL is currently provided between the intersections of Holmes Road and Dan Fox Drive. This treatment can improve capacity and traffic flow along a corridor by removing left-turn traffic from the mainline. However, application of a TWLTL is commonly used in developed areas with a high frequency of low volume driveways such as strip commercial developments. This often results in motorists exiting driveways and using the TWLTL as a refuge or acceleration lane. This treatment typically loses its efficiency when roadway daily traffic volumes are over 24,000 vehicles per day.[6]

Aside from separating the mainline left turning traffic from the through movements, the safety and efficiency of this treatment is contingent primarily on driveway location, spacing and volume. Driveways on opposite sides of a roadway where this treatment is applied should be located such that opposing left-turn movements on the mainline can be completed by a vehicle without having to occupy the same portion of the TWLTL. Furthermore, driveways should be spaced adequately such that vehicles making left-turns from a property do not conflict with vehicles at adjacent driveways.

Advantages

- Removes left-turn movements from main travel lane which could result in an increase in vehicle safety when compared to a roadway with no TWLTL;
- Increases capacity compared with an undivided roadway; and
- Reduces delay compared with undivided roadways.

▼

[6] Access Management Manual, Transportation Research Board of the National Academies, 2003

Disadvantages

- Efficiency of TWLTL is compromised when traffic volumes reach 24,000 vehicle per day;
- Lane can be used as an acceleration or deceleration lane;
- Doesn't restrict turn movements, and full access is permitted from driveways;
- Accommodates strip development along major roadways with frequent access points, which can lead to safety issues if driveway spacing is inadequate;
- Longer pedestrian crossings with no refuge area; and
- Overlapping left-turn movements.

Center Planted Median

Non-traversable raised medians can provide improved access control, capacity and safety along a corridor. Implementation of a raised median limits the majority of private driveways to right-in/right-out operation thus reducing the number of vehicle conflict points and the amount of information that motorists have to process before and during a movement. However, turn-around locations (or u-turns) also need to be constructed at critical intersections to allow vehicles access to properties on both sides of the roadway. The following are some reasons to consider a raised median along the Route 7/20 corridor:

- Research has concluded that raised medians reduce crash rates by approximately 30-percent over a roadway that has a TWLTL.[7]
- As stated in the previous section, research has found that raised medians are increasingly safer than roadways with a TWLTL when volumes exceed 24,000 to 28,000 vehicles per day.
- Other criteria indicates that when the average daily traffic on the major roadway exceeds 10,000 vehicles per day, travel speeds are between 30 mph and 45 mph, and peak-hour left-turn movements are over 150 vehicles per mile.

Advantages

- Improves safety through reduced vehicle conflicts by separating opposing movements;
- Driveways on opposites sides of the roadway can be located closer together;
- Reduces length of pedestrian crossings and establishes a pedestrian refuge;

[7] Gluck, J., H.S. Levinson, and V. Stover, *NCHRP Report 420: Impacts of Access Management Techniques.* TRB, National Research Council, Washington, D.C.; 1999.

- Improves traffic mobility by removing delay caused by left-turning vehicles; and
- Has the potential to reduce the number of crashes than if no median is present.

Disadvantages

- Restricts driveway movements to a right turn in and out only;
- Requires u-turns to be accommodated at intersections, which could require additional right-of-way to accommodate movements; and
- Could require roadway widening and impacts to adjacent businesses and parking.

Shoulder Treatments

Shoulder widths can have a significant impact on mobility and vehicle safety. As currently configured, the Route 7/20 corridor has two foot shoulders; which does not meet current design standards. It is important to note that design standards have changed since the existing Route 7/20 roadway cross section was constructed. Also, wider shoulders become more critical when coupled with a raised median, as the median's presence limits the space for evasive maneuvers.

The MassDOT Project Development and Design Guide provide a summary of shoulder widths that are recommended to accommodate various functions; see Table 5-2 below. It is important to note that since the corridor is on the National Highway System (NHS) eight foot shoulders are typically required for outside travel lanes while two foot shoulders are required on the lane nearest the median.

Table 5-2
Minimum Shoulder Width (in feet) to Provide Various Functions

	Roadway Type	
Shoulder Function	**Arterials**	**Collectors**
Drainage of Traveled Way	1.0	1.0
Lateral Support of Pavement	1.5	1.0
Encroachment of Wide Vehicles	2.0	2.0
Off-tracking of Wide Vehicles	2.0	2.0
Errant Vehicles	3.0	2.0
Bicycle and Pedestrian Use	4.0	4.0
Emergency Stopping	6.0	6.0
Emergency Travel	6.0	6.0
Mail Delivery and Garbage Pickup	6.0	6.0
Law Enforcement Operations	8.0	6.0
Large Vehicle Emergency Stopping	10.0	10.0
Occasional Travel/Detours	10.0	9.0
Highway Maintenance	8.0	8.0

Source: MassDOT Project Development & Design Guide, Table 5-11.

Secondary Roadways

The following section reviews secondary roadway treatments that could be considered along the corridor. A secondary roadway typically parallels an arterial roadway and is used to limit direct access to the arterial by adjacent parcels. The goal of these treatments would be to reduce the number of access points directly to the study area corridor through the creation of other roadways. The following treatments were considered:

- Frontage/Service Roads; and
- Reverse Frontage Roads.

Frontage Roads

Frontage roads are constructed to run parallel to the corridor along the frontage of several adjacent parcels and between the roadway right-of-way and the front building setback. These roadways provide interconnectivity between the parcels and shared access/egress points. Construction of a frontage road would usually occur prior to or as parcels are developed, and the actual roadway may be located on private property.

This treatment may not be feasible along the majority of the study area corridor since parcels are generally small and frontage is not available. Construction of a frontage road in most areas along the corridor would require additional right-of-way and would impact existing buildings and parking areas. The following lists some advantages and disadvantages for frontage roads.

Advantages
- Improves safety through reduced traffic conflicts on major arterial;
- Improves mobility by consolidating arterial access points;
- Businesses are still visible from the major roadway; and
- Provides interconnectivity between land uses.

Disadvantages
- Operational and safety problems can occur if the distance between the frontage road and crossroad is inadequate;
- Frontage road serves properties on one side only;
- Can be costly if property acquisition is needed to implement;
- Can require easements between property owners; and
- Restricts driveway movements to a specific location.

Reverse Frontage Roads

Reverse frontage roads, or sometimes called service roads, are somewhat similar to a frontage road. However, the primary difference is they typically run along the rear of adjacent parcels. This allows for access on both sides of the reverse frontage roadway and can provide opportunities for parcels to be subdivided or provide access for land-locked parcels, thus providing additional development opportunities.

Reverse frontage roads can be an effective alternative to frontage roads where there are an abundance of small parcels located against the mainline right-of-way, similar to the Route 7/20 corridor. The following lists some advantages and disadvantages for reverse frontage roads.

Advantages
- Improves safety through reduced traffic conflicts on major arterial;
- Improves mobility by consolidating arterial access points;
- Businesses are still visible from the major roadway;
- Provides interconnectivity between land uses; and
- Provides opportunities for additional development on both sides of the roadway.

Disadvantages
- Operational and safety problems can occur if the distance between the reverse frontage road and crossroad is inadequate;
- Can be costly if property acquisition is needed to implement;
- Can require easements between property owners;

- Restricts driveway movements to a specific location; and
- Could require additional signage or way-finding signs to guide patrons to businesses.

Controlled Access

Traffic signals can be used to provide protection for specific movements at key locations and to properties that generate a significant amount of traffic. Currently there are four traffic signals located along the corridor, and two of these signals provide access to parcels. The two intersections that provide access to adjacent parcels are the New Lenox Road traffic signal which provides access to a car wash and to the Five Chair Restaurant, and the intersection of Center at Lenox which also provides access to Sophia's and Burger King via the Holmeswood Terrace cul-de-sac. Traffic signals can create gaps in through traffic both up- and down-stream from the signal location resulting in improved capacity for other unsignalized driveways. The following provides an overview of the existing traffic signals along the corridor and traffic signal spacing.

Signal Spacing

While a signalized intersection or driveway provides the best and safest alternative for a controlled access to a driveway or intersection, traffic signals should not be installed unless certain thresholds are met. Typically the advantages need to outweigh the disadvantages, so to provide some consistency on their installation, a series of warrants should be reviewed to define minimum conditions under which a traffic signal may be appropriate. These warrants include the review of traffic volumes, pedestrian volumes, school crossings, progression movements, and crash experience. These warrants are currently defined in the national publication of the Manual of Uniform Traffic Control Devices (MUTCD). One of these warrants would be met if the two lane Route 7/20 corridor generated more than 630 vehicles per hour, and a one lane side street or driveway generated more than 53 vehicles per hour for at least eight hours of the day; this assumes that vehicles speeds on Route 7/20 are over 40 mph.

However, even if warrant thresholds were met, in order to preserve the mobility of the Route 7/20 corridor, traffic signals need to be spaced so that a vehicle can travel at a reasonable speed. The optimal spacing for traffic signals typically depends on the cycle length and the posted speed limit. Shorter cycle lengths and lower speeds enable closer spaced traffic signals, and having uniform spacing is essential. Table 5-3 illustrates traffic signal spacing standards that could be considered along the Route 7/20 corridor. However, further engineering assessment should be used rather than just the information in the table below. The following summarizes the corridor's current traffic signal spacing when interpolating from Table 5-3 and using the current signalized cycle length for the traffic signals along the corridor (65 seconds).

- New Lenox Road to Holmes Road: a signal spacing of approximately 1,584 feet would be ideal for vehicle speeds of approximately 35 mph;
- Holmes Road to Center at Lenox: a signal spacing of approximately 1,426 feet would be ideal for vehicle speeds of approximately 30 mph; and
- Center at Lenox to Dan Fox Drive – a signal spacing of approximately 2,164 feet would be ideal for vehicle speeds of approximately 45 mph.

Table 5-3
Signalized Intersection Spacing

Cycle Length (Seconds)	Operating Speed (mph)				
	30	35	40	45	50
60	1,320	1,540	1,760	1,980	2,200
70	1,540	1,800	2,050	2,310	2,560
80	1,760	2,050	2,350	2,640	2,930
90	1,980	2,310	2,640	2,970	3,300
100	2,200	2,570	2,930	3,300	3,670

Source: NCHRP Report 348, Access Management Guidelines for Activity Centers, Table 7-2, page 59.

The signal spacing between Dan Fox Drive and the Center at Lenox is 2,164 feet, and with a signal cycle length of 65 seconds, which may explain why the 85th percentile speed in this area exceeds the posted speed limit of 40 mph.

Driveway Design Standards

While driveways should be designed (width, radii, etc.) to accommodate the most appropriate design vehicle, the following section reviews critical driveway design standards that could improve access and circulation along Route 7/20. It should be noted that the existing characteristics of the corridor (driveway spacing, parcel size, etc.) may result in many of these standards not being met, but these standards should be considered if and when a parcel is redeveloped.

The following treatments are discussed in this section: Driveway spacing; Corner Clearances; Joint and Cross Access; Sight Distance; and Throat Length.

Driveway Spacing

When driveways (or intersections) are located and spaced properly, vehicle safety and mobility for the corridor can be enhanced. Providing adequate spacing between driveways allows for safer turning movements in and out of driveways. Longer distances between driveways also provide safer travel for bicycles and pedestrians by providing fewer conflicts. Eliminating or reducing driveway offsets (driveways located on opposite sides of the roadway) should be considered if the corridor is undivided.

As the roadway functional classification increases, spacing standards become more stringent and driveways are spaced further apart. This is typically a result of vehicle speeds being higher on arterials than local roadways, and driveway spacing is typically based on vehicle stopping sight distance (SSD). Stopping sight distance is the distance it takes for a vehicle to stop before hitting an obstruction in the roadway while traveling at a certain speed.

Driveways spaced too close to each other can result in an increase in vehicle conflicts, and can create safety issues. Therefore, driveway spacing standards should be considered. Typically two different standards are created, including: (i.) standards for an undivided roadway, such as the Route 7/20 corridor, and (ii.) standards for a divided roadway, or a roadway with a median. Tables 5-4 and 5-5 provide recommended spacing for each scenario.

Minimum Spacing Between Opposite Side Driveways: It is desired to have driveways aligned with driveways directly on the opposite side of the roadway. If this is not possible, it is then desired to have driveways offset by an appropriate distance, as summarized in Table 5-4. These distances are measured from centerline of the proposed driveway to the centerline of the driveway on the opposite side of the roadway. However, these spacing standards may not be possible along some sections of the Route 7/20 corridor.

Table 5-4
Driveway Spacing – Opposite Side of Roadway (undivided)

Posted Speed	Required Min. Driveway Spacing
30 mph	370 feet
35 mph	460 feet
40 mph*	530 feet*
45 mph	670 feet
50 mph	780 feet

Source: NCHRP Report 348, Access Management Guidelines for Activity Centers, Table 7-8 page 63.
* The posted speed limit on the Route 7/20 corridor is 40 mph.

Minimum Spacing between Adjacent Driveways: For driveways on the same side of the street, the required minimum driveway spacing summarized in Table 5-5 should be measured from the centerline of the proposed driveway to the centerline of the adjacent driveway. This spacing is more applicable for a corridor that is divided and movements consist primarily of a right-turns in and/or out only. The measurements in Table 5-5 are based on the acceleration rate of a vehicle exiting a driveway, and the deceleration rate of a vehicle approaching the driveway that the vehicle just exited. However, these spacing standards may not be possible along some sections of the Route 7/20 corridor.

Table 5-5
Driveway Spacing – Same Side of Roadway (Median)

Posted Speed	Minimum. Driveway Spacing
30 mph	185 feet
35 mph	245 feet
40 mph*	300 feet*
45 mph	350 feet
50+ mph	450 feet

Source: TRB, Access Management Manual, Table 9-7, page 152.
* The posted speed limit on the Route 7/20 corridor is 40 mph.

Corner Clearances

Corner clearances are the distances between an intersection and the nearest driveway. Typically corner clearances would meet or exceed the driveway spacing requirements. However, driveways should typically not be located within the functional area of the intersection, and if a driveway is located within the functional area, it should be restricted to a right-turn in/out, right-turn in, or right-turn out only.

Joint and Cross Access

The Route 7/20 corridor has a high density of access points. This is especially true in the segment between the Center at Lenox and Dan Fox Drive where 30 driveways are present over a 0.41 mile stretch, which translates into an access density of 73 driveways per mile. Consolidating access points through joint and cross access provisions provides a unified property access and circulation system between two parcels. Implementing either joint or cross access can provide many advantages to the corridor. The following provides some key advantages and disadvantages.

Advantages

- Reduces the number of individual access points;
- Increases access spacing;
- Provides customer convenience for circulation between properties,
- Landscaping increases along the properties frontage; and
- May improve circulation and parking layout.

Disadvantages

- Properties cannot be forced to implement this technique, and must redevelop for this technique to apply;
- Closure or sharing of driveways can be contentious and involve legal agreements for liability; and
- Local and State officials must be on same page for effective implementation.

Sight Distance

Sight distance is always the most important consideration in the placement of driveways, as it provides the maximum safety for the general public and provides access for the property owner. Both vertical and horizontal alignment can limit sight distance. The following provides a summary of stopping sight distance and intersection stop distance.

- *Stopping sight distance:* is the length of roadway ahead visible to a driver and ensures that drivers have sufficient visibility to anticipate and avoid collisions before reaching a stationary object in the roadway.
- *Intersection sight distance:* is the view a driver has from the side street (the Site driveway, for example) of approaching traffic. The desirable values for intersection sight distance are such that the major-street traffic would not have to substantially reduce its speed when the driver exits the side street and into the main flow of traffic.

Sight distance measurements can sometimes be used for the location of driveways. A review of stopping sight distance versus intersection sight distance indicates that using intersection sight distance will result in longer driveway spacing. Required sight distances are typically determined using the 85th percentile speed of a roadway. Sight distance requirements based on speed are summarized below in Table 5-6. For driveway design, AASHTO[8] recommends that (at a minimum) the provision of stopping sight distance (at an intersection) is fundamental to intersection operation.

▼

[8] A Policy on the Geometric Design of Highways and Streets, American Association of State Highway and Transportation Officials [AASHTO], 2004

Table 5-6
Sight Distance Analysis Summary

Design speed (mph)	Stopping Sight Distance (feet)	Intersection Sight Distance (feet)
25	155	280
30	200	335
35	250	390
40	305	445
45	360	500
50	425	555
55	495	610

Source: based on guidelines established in A Policy on the Geometric Design of Highways and Streets, American Association of State Highway and Transportation Officials [AASHTO], 2004.

Throat Length

Throat length is the distance parallel to the centerline of the driveway from the first on-site location where a driver can make a right turn or a left turn to the edge of roadway at the major corridor; which is typically the curb or roadway gutter line. Creating a driveway throat length is important for safe and efficient access to and from the corridor. A sufficient throat length enables drivers to clear the intersection at the corridor before encountering on-site circulation. When vehicle conflict occurs on-site, it can result in poor traffic operation on the corridor and in the vicinity of the intersection.

The following could be considered for driveways where parcels generate less than 50 peak hour vehicles in both the entering and exiting directions. For driveways that generate more traffic, this information should be assessed in greater detail through the preparation of a traffic study and site plan for a particular parcel.

- A driveway throat length should be able to accommodate at least two passenger cars, or a minimum of between 40 and 60 feet depending on the types of vehicles entering and exiting;
- Entering and exiting traffic should be separated with a solid yellow line; and
- Left and right turn lanes can be considered for driveway that are expected to generate significantly more traffic.

Pedestrian Connections

While the 7/20 corridor is a principal arterial, special consideration could be given to improve pedestrian connectivity across the corridor at signalized intersections and between parcels. While the corridor has sidewalks on both sides of the roadway, there are limited opportunities to actually cross the corridor. While there may not be a need to install these treatments now, the application of pedestrian crossings may be more relevant in the future, and therefore should be considered if there is any future roadway or intersection improvement projects or when parcels are redeveloped. To summarize previous Chapters, there are two corridor crossings, which are located:

- at the Center at Lenox signalized driveway. There is an exclusive pedestrian phase for pedestrians utilizing the crosswalk across the northbound Route 7/20 approach. This is the only signalized crossing of Route 7/20 within the corridor. There are crosswalks across the Holmeswood Terrace and Center at Lenox approaches; however they are not signalized.

- just to the north of West Mountain Road. There is an unsignalized mid-block crosswalk with advance signage along the corridor.

In addition to these crossings, the Center at Lenox has proposed an interconnecting pedestrian walkway between the Yankee Candle store and the Center at Lenox. This connection will be constructed as part of the redevelopment project for the Center at Lenox which at the time this study was being constructed.

The following reviews various pedestrian crosswalk treatments that could be considered along the corridor at existing or future locations.

Mid-Block Treatments

There have been several pedestrian-related vehicle crashes that have occurred along the corridor, some where the vehicle struck the pedestrian, but most incidents involved two vehicles, one of which was stopping for pedestrians in the mid-block crosswalk north of West Mountain Road. To enhance this crosswalk, a variety of crosswalk treatments could be considered. Treatments include:

- *In-Pavement Lights:* lights are imbedded in the pavement to better define the location of crosswalks at night.
- *Flashing Beacons:* Supplemental flashing beacons to alert drivers that there is a crosswalk ahead and that pedestrians are crossing corridor.

However, this application is typically not encouraged by MassDOT on urban principal arterials like Route 7/20.

- *Supplemental Signage:* A number of incidents involved vehicles being rear-ended after having stopped for pedestrians crossing Route 7/20. Additional warning signs could be installed to provide motorists with advanced notice of a crosswalk and that vehicles may be stopped ahead.
- *Eliminate Crosswalk:* Eliminating the mid-block crossing could be considered an option; however, special consideration should be given to the location and use of the bus stops located on both sides of Route 7/20 near the mobile park.

Several advantages and disadvantages should be considered before implementing this alternative. The following provides a summary of each:

Intersection Crossings

Consideration could be given to providing new pedestrian crossings of Route 7/20 at existing signalized intersections. However, since there is currently limited pedestrian activity along the corridor, this treatment could be considered in the future if warranted or if improvements are made to the signalized intersections.

Public Transit

Bus service is provided along the corridor by the Berkshire Regional Transit Authority (BRTA). Scheduled stops off the corridor are currently provided at the Stop & Shop Plaza (off Dan Fox Drive) and at the Center of Lenox. Bus stop turnouts are provided along the corridor at the following locations:

- two stops located on either side of the roadway just north of Holmes Road and in the vicinity of Yankee Candle store, and
- two stops located on both sides of the roadway just to the south of Holmes Road and between the Berkshire Mobile Park and Arizona Pizza.

These locations encourage mid-block pedestrian crossings. Typically it is desired to have bus stops located on the far side of a signalized intersection. This reduces the delay at the intersection, and promotes pedestrian crossings at a signalized intersection. The relocation of these stops could require additional right-of-way, and may not be feasible in some areas near existing traffic signals due to wetlands, endangered species, or significant changes in topography. Bus stop locations should be reevaluated if there is any significant signal or roadway improvements along the corridor in the future.

Turning Restrictions

Turning restrictions restrict specific turn movements at unsignalized access points or driveways. By restricting movements, vehicle conflicts along a corridor can be significantly reduced. The left-turn movement to and from an access point is typically the most critical movement and has the most conflict on a corridor. The following types of driveways with restricted movements could be considered:

- Prohibit all left-turn movements at a driveway;
- Restrict turning movements from TWLTL during peak hours;
- Channelized right-turn in/out, right-turn in, or right-turn out driveways; and
- Provide entrance or exit only driveways.

The restriction of turning movements at driveways can improve safety conditions and corridor operations; however, these restrictions can be difficult to enforce unless physical barriers like a raised median or raised channel are incorporated into the corridor or driveway.

5.2 Land Use Regulation Strategies

Since the Route 7/20 corridor is fully developed, and it is difficult to apply retrofit strategies due to the narrow right-of-way and smaller parcel sizes, additional land use regulation strategies need to be considered for the corridor. These regulations would include applying access management techniques specific to the corridor that should be considered when a parcel is redeveloped. This section will review the following:

- Site Plan Review;
- Traffic Impact and Access Studies (TIAS); and
- Zoning Regulations.

5.2.1 Site Plan Review

The intent of the site plan review is to set a series of standards that developments need to comply with. When reviewing a site plan, the local permitting agency should assure that all structures and uses are developed in a manner which considers community needs, including protection of abutting properties and visual amenities, convenience and safety of vehicular and pedestrian movement within the site and in relation to adjacent corridor, adequacy of methods of disposal for wastes and surface water drainage and protection of environmental features on the site and in adjacent area.

The following provides a list of some of the more critical items that should be considered on a site plan to help assess corridor access issues:

- Proposed and existing access points within five hundred (500) feet on either side of the corridor, and along both sides of any adjoining streets, shall be shown and dimensioned on the site plan.
- Distances to existing adjacent access points, traffic signals and intersections.
- Number of turning lanes to be provided on the proposed driveway.
- Striping and signing plans.
- Parking and internal circulation plans.
- Plan showing all existing property lot lines, easements, rights-of-way, lot size in acres or square feet, abutting land uses and location and use of structures within three hundred (300) feet of the site.
- The proposed clear vision, or sight triangles, of all curb cuts leading to the public way should be illustrated.

The local permitting agency can approve a site plan subject to conditions, modifications and restrictions as deemed necessary, and to ensure the improvement of a road or utilities to accommodate increased demand likely generated by the proposal.

5.2.2 Traffic Impact and Access Studies (TIAS)

The preparation of a traffic study is a critical element of traffic and site engineering and can provide an assessment of site access and off-site intersection and roadway impacts associated with a particular development or redevelopment. As a result, a traffic impact and access study (TIAS) customarily provides important information regarding present and future impacts of a development or redevelopment on the operation of the surrounding infrastructure and the associated mitigation for such impacts. Establishing a standardization process for the Route 7/20 corridor would be an important process to ensure safe access and maintain mobility along the corridor.

The following provides guidelines to assist municipalities in determining how detailed a TIAS may need to be for a particular development or redevelopment. By developing some general guidelines municipalities are able to standardize and improve their decision making process.

1. Initial meeting or discussion with municipality and MassDOT

2. Analysis of Roadway Issues
   - Evaluate existing study area characteristics
   - Proposed driveway sight distance evaluation
   - Evaluation of nearby driveway locations
   - Evaluation of existing traffic conditions in study area
   - Identify other future roadway improvements
   - Crash experience at the study area intersections
   - Identify background traffic growth
   - Future conditions analysis at nearby intersections
   - Mitigation identification and evaluation

3. Site Issues
   - Traffic generation
   - Traffic distribution
   - Evaluation of proposed access points
   - Evaluation of site circulation

4. Other Analysis
   - Vehicle gap analysis for unsignalized intersections or driveways
   - Transportation Demand Management (TDM) measures

Identifying the study area is one of the most critical items that need to be identified as part of the TIAS development process. Adjacent street traffic and peak hour trip generation are commonly called out as critical characteristics when determining the study area. These two characteristics should be considered in the decision making process. For the Route 7/20 corridor, the increments of site generated traffic that is typically experience for adjacent uses is illustrated in Table 5-7 below.

Table 5-7
Study Area Thresholds

	PEAK HOUR TRAFFIC (VPH)			
	$T \leq 50$ vph	$51 < T \leq 100$	$101 < T \leq 150$	$T > 151$
Proposed development access point analysis (proposed driveways only, and their impact on the adjacent roadway)	X	X	X	X
Adjacent roadway control point analysis (one or two intersections on each side of the proposed driveways)		X	X	X
Study area key locations analysis (any number of intersections that are determined will be affected by the development)			?	X

Key: X = required
? = may be appropriate on a case-by-case basis

This trip generation information of a particular development should shared with the local municipality or planning prior to determining the level of study required.

It is important to note that traffic professionals will always have to use professional engineering judgment when deciding how to conduct a TIAS for a particular development. However, the above table could be very useful in providing guidelines to non-technical decision makers.

Examples of Traffic Study Practices

There are many examples of ordinances regulating a Traffic Impact and Access Study, some being extremely stringent and others being extremely limited in their scope. This section provides examples of regulations in two Bylaws from other Cities in the Commonwealth.

City of Marlborough

Projects within the City of Marlborough that require analysis of traffic impacts are described in Article VIII of the City's Zoning Ordinance as the following:

All projects over fifty (50) housing units, or twenty five thousand (25,000) square feet nonresidential floor area, or fifty (50) hotel rooms.

The City Engineer and Director of Planning can waive the requirement for a traffic study if it is deemed unnecessary, or require a study for smaller projects if it is considered necessary due to existing or anticipated issues surrounding the project area. The City Engineer and Director of Planning determine which intersections are to be studied, with the condition that no intersection or street where project-related traffic is expected to make up less than 5-percent of traffic be required for study. Mitigation is required for any studied intersection with an anticipated level of service (LOS) of E or worse.

The City of Marlborough's Traffic Report Checklist is included in the Appendix for further reference.

City of Greenfield

All proposed projects within the City of Greenfield are required to provide information related to trip generation and traffic flow patters both on- and off-site. Projects generating more than 500 vehicle trips per day (or 1,000 vehicle trips per day in the General Commercial District) are subject to the Town's Major Development Review (MDR) regulations. The MDR process requires a Project

Impact Statement that responds to a series of specific project-related requirements.

For traffic, the MDR process requires a specific set of traffic data/analyses for all streets and intersections that are adjacent to the project, and will experience a 10% or greater increase in peak hour traffic, and will experience a reduction in level of service as a result of the project. In addition, the requirement also states that all intersections that are currently failing, and will experience an increase in traffic as a result of the project, are required to be studied and mitigated.

A copy of the MDR guidelines is included in the Appendix.

5.2.3 Zoning Regulations

Corridor Overlay District

An overlay district would add special access management requirements to an existing zoning district along the corridor while retaining the requirements of the underlying zoning. In the case of the Route 7/20 corridor, an overlay district would tailor a variety of access management techniques related to the Route 7/20 corridor. This district would be created through amendments to the Lenox Zoning By-law and the Pittsfield Zoning Ordinance. The advantages of is that the current zoning along the corridor would not need to be changed, and it can be tailored specifically to the corridor. In addition, incentives can be included as part of the overlay district that would encourage developers to implement access management techniques, including signage, setbacks, shared parking, etc. However, an overlay district can lead to making the underlying zoning more complicated and increasing the administrative procedures for the Town of Lenox or City of Pittsfield. More importantly, developers have the option of relying solely on the underlying zoning and could avoid compliance with the access management provisions of the overlay zone.

The following provides a summary of the overlay access management provisions that could be applied to the corridor through an overlay zone:

- *Setbacks:* would preserve sufficient land area along the corridor for potential future right of way expansions, application of access management techniques, and corridor aesthetic improvements.

- *Parking:* provide alternatives to traditional parking design and limit unnecessary amounts of impervious surfaces.

- *Driveway Placement:* the purpose of this would be to create driveway spacing requirements that simplify driving along the corridor by reducing the amount of information a driver must process and react to. Locating driveways away from the operational area of a signalized intersection decreases the potential for congestion and crashes for both through traffic and vehicles using the driveway. Adequate spacing between driveways and un-signalized roadways or other driveways can reduce confusion. Inadequate spacing requires drivers to watch for ingress and egress traffic at several points, while simultaneously trying to control their vehicles and monitor other traffic conflicts ahead of and behind them. However, implementing this as part of a corridor that is built out may be controversial, and therefore is typically not included in the overlay.

- *Cross Access, Parking Lot Connections and Shared Access:* The purpose of this would be to provide guidance for circumstances that may exist where direct access, consistent with the driveway spacing standards of the overlay district, cannot be achieved, or the construction of an alternative means of access will minimize the number of driveways. The use of cross access driveways, and shared drives shall ensure that traffic is able to safely and efficiently ingress and egress onto the corridor, and shall provide for alternative means of access to properties along the corridor.

- *Drive-thru Standards:* standards for location of menu boards, pick-up windows and providing adequate storage for vehicle queuing.

- *Landscaping Requirements:* providing standards and requirements for front yard landscaping requirements and internal parking landscaping.

- *Traffic Study and Site Plan Requirements:* provide standards and requirements for identifying traffic impacts and land use access, parking and circulation.

Zoning Changes

Changes to the existing local zoning codes could effectively implement access management improvements along the corridor. This is best achieved through the creation of a new zoning district that would apply to the study area as opposed to an overlay district where compliance is optional. This would allow the municipality to establish zoning regulations specifically for access management and set criteria to promote more creative site design, and thus applying access management techniques similar to those that have been identified in this Chapter. This technique may be used to integrate land uses, access and circulation systems to create a unified design for the corridor.

5.3 Access Management Programs

The following sections provide a quick summary on the access management guidelines that were prepared for the Berkshires in 2002, and other access management practices that are currently being used in other parts of the country. The intent of these sections is to provide the reader with an opportunity to understand how access management is currently being applied in other areas. It is important to note that when access management guidelines are prepared, the following objectives should be considered:

- Limit the number of conflict points along the corridor;
- Separate conflict points;
- Remove turning vehicles from the major thoroughfare;
- Limit conflicting points to access points with lower volumes;
- Improve intersection and roadway operations;
- Improve pedestrian safety; and
- Improve the safety and operations of access points to private parcels.

5.3.1 Berkshire Regional Planning Commission

In 2002, the BRPC created Access Management Guidelines for municipalities, businesses and other users to help prevent and/or reduce unnecessary traffic congestion and safety problems along roadway corridors that resulted from inappropriate redevelopment or development, improper site design, and poor transportation planning and design. A general tool box of access management techniques were developed as part of this effort. The following techniques were reviewed as part of this toolbox:

- Policy and Regulatory Techniques (Land Use Intensity, Driveway Permitting, Shared Access, Cross Access, and Access Management);
- Driveway Locations and Design (Spacing, Design, Number, Consolidation and Alignment/Offsets);
- Service Road and Reverse Frontage
- Controlled Access (Traffic Signals);
- Roadway Treatments (Lane and Median Treatments);
- Vehicle Guidance (Turn Prohibitions and Signage);
- Alternative Modes of Travel (Bicycle and Roadway Provisions);
- On-Site Treatments and Standards (Corner Lot, Lot Frontage, Landscaping, and Lighting).

5.3.2 Massachusetts Department of Transportation

MassDOT has an active role in access management with the responsibility to issue access permits for all new or modified curb cuts and for modifications of existing curb cuts on state-owned roadways. In addition, for projects that fall under the MEPA process, DOT's Public/Private Development Unit (PPDU) monitors development proposals that may impact state highway. The access permit and MEPA process was described in greater detailed in Chapter 3 of this study.

The goal established by MassDOT is to provide for safe and efficient access while maintaining safety and the operational integrity of the highway. Access management techniques and land use controls are briefly reviewed in MassDOT's Project Development and Design Guide under Chapter 15 Access Management. While there are no set standards for applying access management techniques, design standards are discussed in greater detail throughout the design manual.

For more information on this manual, please see the following online link:

http://www.mhd.state.ma.us/default.asp?pgid=content/designguide&sid=about

5.3.3 Ohio Department of Transportation

The Ohio Department of Transportation's (ODOT) *Access Management Manual* was created to set procedures and requirements governing the issuance of permits for driveways and roadways intersecting state highways. The principles set in the manual are more complex than most and put a higher emphasis on access spacing. Five roadway categories are defined in the manual, and the following summarizes some of the guidelines provided:

- Access is based on low and high emphasis access management techniques for different driveway categories, including driveways that generate low (5 to less than 100 vph) and medium (100 to less than 200 vph) traffic volumes. High emphasis access is defined as having a higher set of access standards. Access is also defined for interchanges, intersections and high volume driveways (greater than 200 vph).

- Auxiliary lanes guidelines are provided for when a separate turn lane is required for unsignalized access points.

- Driveway geometrics are based on four basic driveway guidelines and standards are set based on the amount and type of traffic using the driveway.

- Traffic Impact Studies (TIS) are required when a particular driveway generates 100 vehicles or more during the peak hour of that use. The manual indicates that a project should not further impact the existing level-of-service (LOS) of the specified roadway. For a Category III roadway, which is what the Route 7/20 corridor would fall under, the operations at a driveway or intersection, would need to be maintained at a LOS C.

For more information on this manual, please see the following online link:

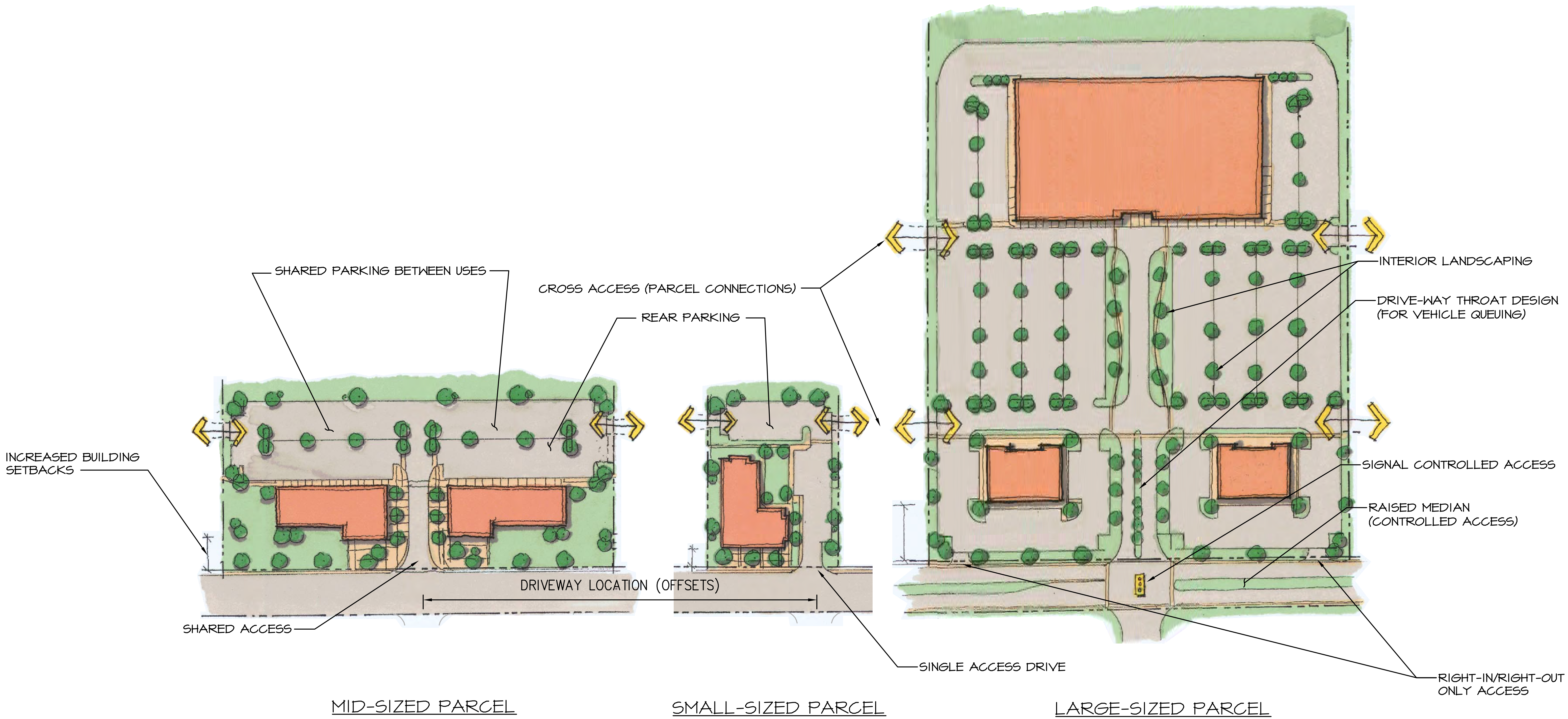
http://www.dot.state.oh.us/Divisions/ProdMgt/Roadway/AccessManagement/Documents/State%20Highway%20Access%20Management%20Manual%20March%202008.pdf

5.4 Site Plan Prototypes

This section reviews three example site plans that reflect lot sizes and physical constraints of developable, or re-developable, parcels within the Route 7/20 corridor. The intent is to illustrate example site plans that integrate access management techniques that were discussed in this Chapter. Coordinating with the Study Management Committee, the following three prototype site plans were been prepared. These plans are illustrated in Figure 5-1.

- Small-to-mid size parcel, for a stand-alone commercial establishment.
- Mid-size parcel or an aggregate of parcels, for a commercial or retail multi-tenant site.
- Large size parcel or an aggregate of parcels, for a large scale commercial or mixed use development with outparcels.

Since adjacent parcels along the Route 7/20 corridor are mostly made up of smaller parcels with some medium and large parcels throughout, the three prototypes were created so that they could be interconnected to illustrate the true benefit that access management may have. The parcels have been arranged in Figure 5-1 to illustrate this.



Vanasse Hangen Brustlin, Inc.

Figure 5-1

Site Plan Prototypes

Route 7/20 Corridor
Access Management Plan

Not to Scale

6

Corridor Improvement Opportunities

This chapter provides an overview of the roadway and access improvements that were considered for the Route 7/20 corridor. The recommendations described in this chapter build upon information from previous chapters including existing corridor safety and driveway access issues, existing and future intersection operations, land development and redevelopment opportunities, and the application of transportation access management strategies.

The following sections present a general overview of each opportunity and how it may benefit or impact the corridor. At the end of this chapter, a range of opportunities are recommended for further study. The last chapter to this study will review in more detail the benefits and impacts associated with each of the selected improvements.

- *Left-Turn Restrictions:* reviews peak hour turn restrictions for the two-way-left-turn-lane (TWLTL) and at adjacent driveways;
- *Raised Center Median:* reviews the location of a raised center median that would replace the TWLTL;
- *West Mountain Road Access:* reviews the realignment of West Mountain Road;
- *Mid-Block Pedestrian Crossing:* reviews improvement options for the mid-block crossing near West Mountain Road;
- *Signalized Intersection Pedestrian Improvements:* reviews pedestrian connectivity at signalized intersections;
- *Signalized Intersection Timing and Phasing Adjustments:* review opportunities for enhancing signal operations through timing and phasing adjustments;

- *Driveway Consolidation:* reviews locations where access could be managed better; and

- *Frontage Roadways:* reviews the application of either frontage or reverse frontage roads to the corridor for improved corridor access.

6.1 Evaluating Improvement Opportunities

When reviewing the improvement opportunities, it is important to understand how these improvements may impact the community, corridor operations, regional mobility, environment, etc. Therefore, a series of questions have been developed that will assist in evaluating the improvement opportunities that could be applied to the corridor. At the end of each improvement summary, an evaluation is provided to determine if that particular improvement should be studied in greater detail in the final chapter of this study.

The following provides an overview of the questions that were considered during the development and vetting of candidate improvement opportunities.

1. **Infrastructure Conditions:** What is the magnitude of the infrastructure improvements being proposed?

2. **Mobility Benefits:** What effect does the improvement have on congestion, travel time, pedestrian connectivity and other modes of transportation?

3. **Safety, Security and Technology:** What effect does the improvement have on the crash rate and bicycle/pedestrian safety?

4. **Cost-Effectiveness and Economic Development:** What is the cost to implement the improvement, and will it have an impact on economic development?

5. **Community Effects and Support:** Will the community support the improvement, what are the effects on right-of-way, noise, etc., and will it be supported by local and state agencies?

6. **Land Use and Economic Development Benefits:** What are the impacts on business, parcel size, access, etc., and are the improvements consistent with land-use and economic development plans?

7. **Environmental Impacts:** What are the environmental impacts, and are there impacts to historic and cultural resources?

6.2 Improvements Opportunities

This section presents the range of candidate improvement opportunities considered for the Route 7/20 Corridor. Included is an overview of the benefits and potential impacts associated with each treatment, along with an evaluation and recommendation. Figure 6-1 illustrates the range of improvement opportunities discussed in this section.

6.2.1 Left-Turn Restrictions

Left-turn restrictions could eliminate either left-turn movements from Route 7/20 into abutting properties, or left-turn movements from abutting properties to Route 7/20. By restricting this movement, vehicle conflicts along a corridor would be significantly reduced. As discussed throughout this study, when there are more conflicts along a corridor, there is a greater chance for crashes as drivers have to process more information and make quicker decisions. The following highlights two specific alternatives that could be applied to the study area corridor.

Restrict Use of Two-Way-Left-Turn-Lane (TWLTL)

The majority of the corridor has a two-way left-turn lane (TWLTL), which extends from Holmes Road to Dan Fox Drive. This center turn lane allows for vehicles to make left-turn movements from both the northbound and southbound direction on Route 7/20 without slowing down or stopping vehicles in the main through lane. Vehicles utilizing this lane create additional conflict points; therefore, restricting the use of the TWLTL could improve safety. Turn restrictions could be imposed during the peak hours of the day; however, mast arms with left-turn restriction signage over the TWLTL would need to be installed to ensure adequate visibility of this restriction. Enforcement of this restriction would be important to ensure its success.

Existing corridor traffic data was reviewed to determine if this alternative should be further evaluated. The following summarizes this information:

- During the weekday morning peak hour (8:00 am to 9:00 am), 33 vehicles use the TWLTL between Holmes Road and the Center at Lenox, and 91 vehicles use this lane between the Center at Lenox and Dan Fox Drive with approximately 55-percent of these turns in the City of Pittsfield. The peak hour two-way traffic volumes on Route 7/20 total approximately 1,600 vehicles per hour.

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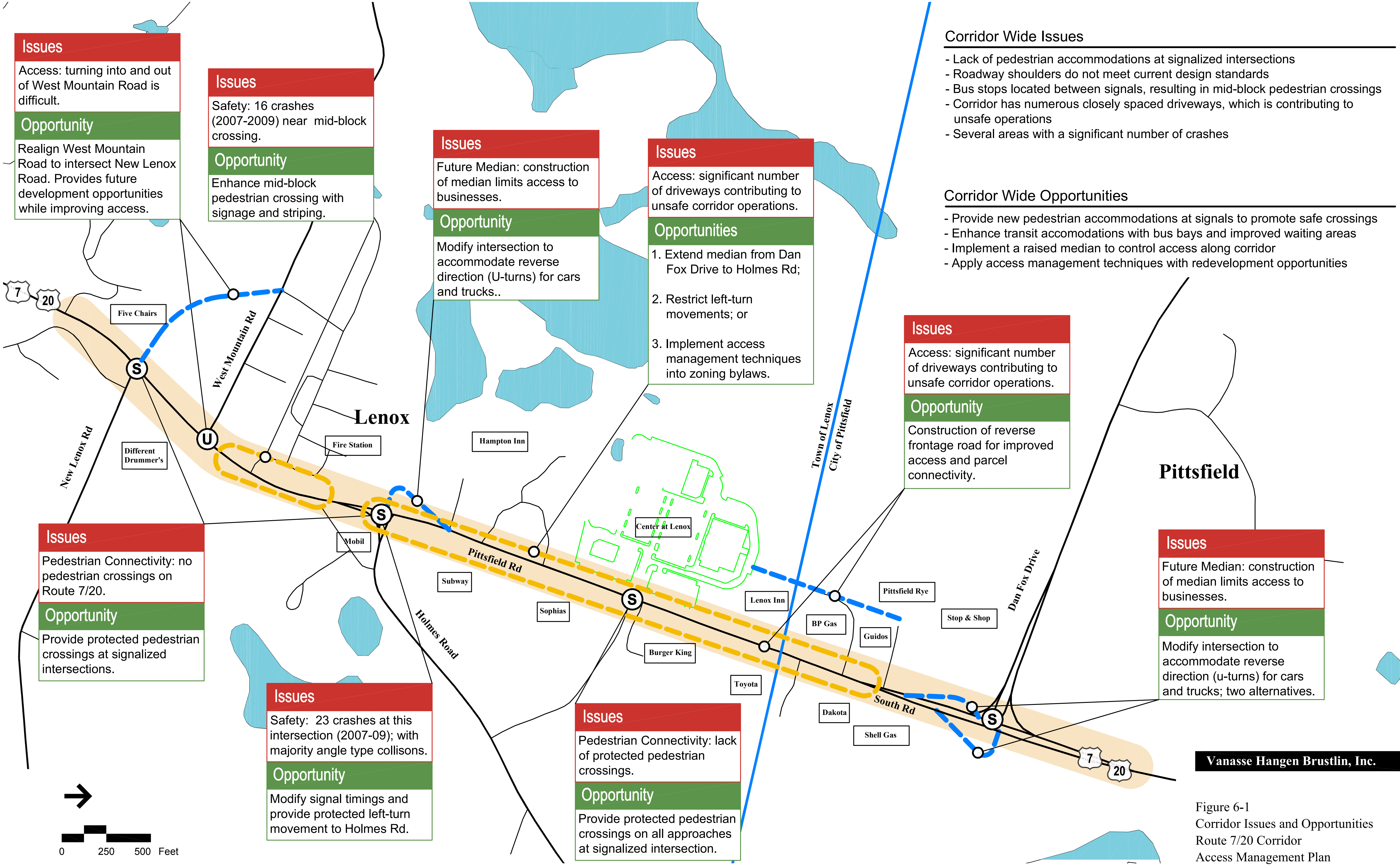

Figure 6-1
Corridor Issues and Opportunities
Route 7/20 Corridor
Access Management Plan

- During the weekday evening peak hour (4:15pm to 5:15 pm), 28 vehicles use the TWLTL between Holmes Road and the Center at Lenox, and 104 vehicles use this lane between the Center at Lenox and Dan Fox Drive with approximately 69-percent of these turns in the City of Pittsfield. The peak two-way traffic volumes on Route 7/20 total approximately 1,900 vehicles per hour.

- During the Saturday midday peak hour (11:15 am to 12:15 pm), 50 vehicles use the TWLTL between Holmes Road and the Center at Lenox, and 140 vehicles use this lane between the Center at Lenox and Dan Fox Drive with approximately 79-percent of these turns located in the City of Pittsfield. The peak two-way traffic volumes on Route 7/20 total approximately 1,600 vehicles per hour.

Evaluation: Traffic volumes stated above for the TWLTL were only collected during the peak hours; however, traffic volumes collected by MassDOT for the TWLTL just to the north of Holmes Road were fairly consistent between 9:00 am and 7:00 pm. During this time the TWLTL averaged 41 vehicles per hour over a 6-day period. While it seems that the TWLTL is consistently used during this time period, traffic volumes along the corridor average 1,600 vehicles per hour, so applying this restriction to just the peak hour may have little effect on safety since volumes are consistent throughout the day.

Enforcement of this restriction could be difficult, and the signing this restriction could be confusing to drivers and could be viewed negatively by businesses. In addition, since left-turns would be restricted vehicles would need to make U-turns at signalized intersections, which most intersections cannot accommodate U-turns. As a result, more drivers may turn left into other businesses parking lots outside the left-turn restriction area to reverse direction.

As a result of the above information, restricting peak hour turn movements from the TWLTL may create other traffic issues along the corridor and therefore should not be considered at this time.

Left-Turn Restrictions (from Driveways)

Restricting left-turn movements from an unsignalized driveway would eliminate a significant amount of vehicle conflicts along the corridor. Given the number of driveways located in close proximity to each other, the driver not only needs to assess through traffic, they also need to assess left-turn movements from other adjacent driveways and from driveways on the opposite side of the roadway. This restriction would also eliminate the use of the two-way-left-turn-lane

(TWLTL) as an acceleration lane, which was an observation that was made earlier in this study.

Existing corridor traffic data was reviewed to determine if this alternative should be further evaluated. The following summarizes this information:

- The corridor experiences, on average, approximately 170 left-turn movements from unsignalized driveways during both the weekday evening and Saturday midday peak hours, and 112 left-turn movements during the weekday morning peak hour. If the left-turns were restricted there would be an increase in the u-turn maneuvers at the nearest signal, which could require changes to signal timing/phasing.

- While implementing this restriction would reduce the amount of conflicts experienced along the corridor; it could be viewed as a negative impact to businesses. In addition, without permanently altering each driveway to restrict movements (i.e. channelized driveways), enforcement is the only means to ensure the success of this measure.

Evaluation: Even though there are a number of left-turn movements from unsignalized driveways, and restricting left-turns would certainly improve safety, the enforcement of this restriction combined with the impact of vehicles having to reverse direction (or u-turn in areas where accommodations to do so are not present) make this an undesirable improvement to consider at this time.

6.2.2 Raised Center Median

Non-traversable raised medians can provide improved access control, capacity and safety along a corridor. Implementation of a raised median limits the majority of access points along the corridor and driveways to right-turn in and out operation. This restriction reduces the number of vehicle conflicts along the corridor by eliminating information or decisions that drivers have to process. In a raised median, vehicles would need to reverse direction (or u-turn) if access to all properties along the corridor were provided. These u-turn areas would need to be constructed at key intersections to allow vehicles (including automobiles and trucks) to have the ability to access properties on both sides of the roadway. The following provides an overview of two locations along the corridor where a raised median could be considered:

New Lenox Road to Holmes Road

A raised median could be considered for the segment of Route 7/20 between New Lenox Road and Holmes Road.

Existing corridor traffic data was reviewed to determine if this alternative should be further evaluated. The following summarizes this information:

- The area north of New Lenox Road to south of Holmes Road was identified in Chapter 2 as a high crash location, with a crash rate equivalent to 3.61, whereas the statewide average is 2.30.

- The public has also expressed concerns about access to and egress from the corridor at West Mountain Road.

- The most used curb-cuts in this area are located at the Mobil Gas Station (averaging 73 entering and exiting vehicles during the morning, evening and Saturday peak hours), West Mountain Road (averaging 62 entering and exiting vehicles), and the Berkshire Mobile Park (averaging 32 entering and existing vehicles).

If a raised median were considered in this area, the following would need to be considered:

- When extending the existing raised median north of West Mountain Road special consideration would need to be given to emergency access to/from the existing fire station, which is located just to the south of the Berkshire Mobile Park.

- Eliminating the northbound left-turn lane into West Mountain Road would restrict turning movements at this intersection to a right-turn in and out only. This would significantly impact access to residential homes and businesses along West Mountain Road.

- The application of a median would require Federal and State approval, which would require existing shoulders to be wider than they are now. As a result, widening of Route 7/20 would be expected, which could:

  - Impact adjacent businesses and roadway utilities.
  - Require the construction of retaining walls and modifications to the Route 7/20 bridge/culvert that crosses the existing wetland.

- o Impact wetlands, endangered species, and may not be feasible due to environmental constraints

Evaluation: Constructing a raised median in this area would improve safety along Route 7/20; however, this may not be feasible without significant environmental impacts. In addition, there may be factors other than just turning movements that are contributing to safety problems of this section of the corridor, i.e. vehicle speeds, stopping sight distance, and the mid-block pedestrian crossing. Given the above mentioned constraints, it was determined that a raised median along this section of the corridor should not be further evaluated at this time. However, other improvements opportunities for this area will be reviewed later in this chapter.

Holmes Road to Dan Fox Drive

A raised center median could be considered to replace the existing TWLTL that exists from Holmes Road to Dan Fox Drive. The corridor would maintain two travel lanes in each direction along Route 7/20 creating a boulevard type roadway. Providing breaks in the center median at unsignalized access points or driveways would not be recommended as this would create unsafe turning movements and u-turns.

Existing corridor traffic data was reviewed to determine if this alternative should be further evaluated. The following summarizes this information:

- ➢ This segment of Route 7/20 consists primarily of two 11-foot travel lanes in each direction and a 12-foot center two-way left-turn lane (TWLTL).

- ➢ North of the Center at Lenox the corridor has the highest density of access points, with a total of 30 over a distance of 1,585 feet. This translates into an access density of 73 access points per mile.

- ➢ In previous chapters it was identified that roadways with an access density over 60 access points per mile increase the likelihood of crashes. The corridor north of the Center at Lenox has experienced 27 crashes over the last three years, which translates into a crash rate of 3.99, which is higher than the statewide average of 2.30.

- ➢ The majority of crashes in this area involve vehicles turning to/from driveways and making lane changes; in addition, vehicles have been observed to use the TWLTL as an acceleration lane.

If a raised median were considered between Holmes Road and Dan Fox Drive, the following would need to be considered:

- Three breaks in this median would be provided at each of the three signalized intersections at Holmes Road, Center at Lenox and Dan Fox Drive.

- U-turns would need to be considered for automobiles and larger vehicles at Holmes Road and Dan fox Drive.

- U-turns for automobiles only would be considered at the Center at Lenox signalized intersection.

- The raised median could vary in width from 4 feet to 10 feet; however, a 10-foot median would be required if landscaping/plantings are to be included, which is something each community would prefer. The 4-foot median would likely be concrete.

- The application of a median would require Federal and State approval, which would require existing shoulders to be wider than they are now. As a result, widening of Route 7/20 would be expected, which could impact adjacent businesses and roadway utilities.

Evaluation: A raised median is an alternative that has been reviewed in the past for this corridor. Given the number of crashes and turning movements observed, and the challenges that may be faced to restrict turning movements, it was determined that this improvement should be reviewed more closely. In the next chapter conceptual improvement plans, general impacts, design and construction costs, and overall feasibility will be reviewed so that local and state officials and adjacent property owners can have a better understanding of the impacts associated with a raised median.

6.2.3 West Mountain Road Access

As discussed in Section 6.2.2, access to/from West Mountain Road is currently a concern. West Mountain Road is a 2-lane local roadway that serves as the primary access to residential properties; however, access is also provided to two commercial properties that abut the Route 7/20 corridor. There are no pavement markings or sidewalks on West Mountain Road. There is a dedicated northbound left-turn lane on Route 7/20 to West Mountain Road. West Mountain Road also provides indirect access to the Berkshire Mobile Home Park.

Existing corridor traffic data was reviewed to inform the development of improvement options. The following summarizes this information:

- The exiting turning movements from West Mountain Road are expected to operate at a LOS D during the weekday evening peak hour and LOS F during the Saturday midday peak hour in 2020. The LOS F conditions are due to the lack of gaps on Route 7/20 which make it difficult for left-turning vehicles to proceed.

- There have been several complaints by the general public about access to Route 7/20 from this roadway, specifically the difficult left-turn movement to the north. Vehicles have been observed turning right and then reversing direction in the parking lot of an adjacent business on the opposite side of the roadway.

The following improvement options were considered:

Intersection Signalization

A traffic signal at this location would allow for protected turning movements to/from West Mountain Road, and present the option of relocating and signalizing the existing midblock pedestrian crossing located to the north of this intersection.

Evaluation: West Mountain Road currently does not generate enough traffic to warrant a traffic signal. In addition, introducing another traffic signal between New Lenox Road and Holmes Road could significantly impact the mobility and traffic progression along the Route 7/20 corridor. As stated in Chapter 5, the existing signals are adequately spaced for a travel speed of approximately 35 mph. Therefore, a traffic signal should not be considered at this intersection at this time.

Roadway Realignment

This option would result in the realignment of West Mountain Road to be opposite New Lenox Road. This would allow West Mountain Road to access Route 7/20 at an existing signal, which is currently underutilized. The current location of West Mountain Road would remain, however the intersection of Route 7/20 would be modified to operate as a right-turn in and out only.

Evaluation: Realigning this roadway would provide an opportunity for future redevelopment of a large piece of property adjacent to West Mountain Road and directly behind the current businesses that abut the corridor. This alternative would provide an opportunity for future economic development while improving access along the corridor. As a result, realignment options will be reviewed in greater detail in the next chapter. In the next chapter conceptual improvement plans, general impacts, design and construction costs, and overall feasibility will be reviewed so that local and state officials and adjacent property owners can have a better understanding of the impacts associated with this realignment.

6.2.4 Mid-Block Pedestrian Crossing

There is a mid-block crossing located just to the north of West Mountain Road, where a total of 12 crashes occurred in this area over the last three years (2007 to 2009). Within the vicinity of this crossing, the Route 7/20 corridor consists of two 12-foot travel lanes in each direction along with 2-foot shoulders. There is an approximately 6-foot wide center median that shadows the northbound left-turn lane at West Mountain Road; which also provides a refuge for pedestrians crossing Route 7/20. Since the crossing installation about ten years ago, MassDOT has provided signage upgrades (at the crossing and in advance) through routine maintenance and in response to citizen concerns at this location. There are advance pedestrian warning signs on both the northbound and southbound approaches to this crosswalk, and warning signs are located at the crosswalk.

Of the 12 crashes, five (5) involved pedestrians, and one was a fatal crash where a pedestrian was struck by a vehicle. The other crashes at this location often involved vehicles being rear-ended when stopped for a pedestrian in the crosswalk. Since the majority of these incidents occurred in the southbound direction, the stopping sight distance in this area was reviewed. Stopping sight distance is the distance available for a vehicle to stop before encountering an object in the roadway. The following summarizes these findings:

- There appears to be approximately 420 feet of stopping sight distance along Route 7/20 (from the outside travel lane) in southbound direction. This information is based on roadway plans that were provided to VHB by MassDOT. The sight distance restriction is caused by a horizontal curve in the roadway.

- The posted speed limit leading up to this crossing is 40 mph. Based on this posted speed limit, 305 feet of stopping sight distance would be required. Therefore, it appears that stopping sight distance is more than adequate for the posted speed limit.

If vehicles are traveling faster than the posted speed limit, and there are vehicles stopped at the crosswalk to allow pedestrians to cross, stopping sight distance could be compromised. For example, a vehicle speed of 45 mph requires a stopping sight distance of 360 feet. Accounting for a vehicle queue of three cars, or 25-feet per vehicle for a total of 75-feet, the previously mentioned available stopping sight distance of 420-feet could be reduced to 345 feet.

While the specific details of vehicle speeds and vehicle queues were not known for all crashes that occurred in this area, it seems that crashes in this area are likely due to the combination of drivers being unaware that there is a pedestrian is in the crosswalk, the horizontal curvature in the roadway, higher vehicle speeds in this area, and the stopping of vehicles on Route 7/20 prior to the crosswalk which reduces the stopping distance for vehicles.

A study conducted by FHWA has found that unsignalized marked crossings had a higher incidence of pedestrian crashes on multi-lane roads with high daily traffic volumes; however, this study also indicated that it is not always appropriate to remove a crossing on a multi lane roadway.

The following crosswalk actions should be considered for this location:

Monitor Crossing

Further pedestrian data should be obtained to determine if this crosswalk is being used more by riders of transit, or pedestrians looking to cross Route 7/20. At the time that this study was being prepared, the Berkshire Regional Transit Authority (BRTA) indicated that the adjacent bus stops (and bus bays) are very lightly used; stops are used maybe once or twice a month. Therefore, additional data, and discussions with local residents, may help determined which of the following improvement measures should be considered.

Evaluation: MassDOT has indicated that they will further evaluate and monitor this location to determine the most appropriate improvement measure to address. However, the following describes three improvement options.

Eliminate Crossing

It is not recommended to eliminate this crossing without eliminating the bus stop that is located on the easterly side of the corridor. The crossing provides a direct access to this bus stop, and the bus stop is likely located here for the residents of the Berkshire Mobile Park. If the crossing were eliminated, this bus stop would need to be relocated closer to the signalized intersections of New Lenox Road or Holmes Road; however, both intersections are over 800 feet away from the driveway to the mobile park.

Evaluation: recommendation to not eliminate the mid-block crossing without further study or other corridor modifications. If it is determined that the crosswalk is being used more frequently by more than just transit riders, further investigation of enhancing this crosswalk should be considered. The following summarizes additional enhancement measures.

Signalized Crossing

Providing a pedestrian-actuated traffic signal at this crossing would provide a significant upgrade in pedestrian safety at this location. Typically mid-block crossings such as this are not anticipated by motorists, which contribute to crashes being caused by trailing vehicles not recognizing the need to slow down in time. The MassDOT design manual states that multi-lane arterial streets a pedestrian call button-actuated traffic signal may be appropriate for further enhancement. However, the application of a signalized mid-block crossing may require that there be more pedestrian activity at this crossing. Further study would be required to assess the feasibility of signalizing this crossing; however, there seems to be more cost effective ways of enhancing this crosswalk through the application supplemental treatments.

Evaluation: seek other improvement alternatives before considering a signalized crossing; see supplemental treatments for alternative measures.

Supplemental Treatments

To further enhance the crosswalk, the following could be considered:

- Consider flashing signals and lights at the crosswalk, and in advance of the crosswalk on at least the southbound approach. This would increase the visibility of the crosswalk and alert motorists that there may be a conflict in the road ahead. This flashing signal could be a constant flash or activated by a pedestrian. Flashing signals installed on a mast arm over the southbound traveled lane could be considered given multi-lane cross section.

- Provide advance pavement markings that would alert drivers of the crosswalk ahead. This could include a stop bar or yield triangles prior to the crosswalk.

- Consider the use of ladder style pavement markings for the pedestrian crossing, and additional signage in the median prior to the crossing. The signage in the crossing should be low to the ground as to not obscure the pedestrian waiting in the median of the crosswalk.

Evaluation: consider the implementation of supplemental treatments to enhance a driver's awareness that this mid-block crossing exists.

6.2.5 Signalized Intersection Pedestrian Improvements

There are four signalized intersections that were included as part of this project's study area. The Dan Fox Drive signal does not have pedestrian accommodations, and at this time, it appears that pedestrian crossings are not warranted given the significant grade changes and lack of development within the immediate vicinity of the intersection. However, since the Route 7/20 study area corridor has sidewalks located on both sides of the roadway, the following pedestrian improvements should be considered:

- *New Lenox Road:* There are no pedestrian crossings provided at this intersection; however, sidewalks along Route 7/20 end at this intersection and on the northerly side. Incorporating pedestrian crossings across all approaches to this intersection would require a significant upgrade to the intersection. Since there are sidewalks that lead to this intersection, a pedestrian crossing should be constructed on at least the northerly side of the intersection. It should be noted that there was one pedestrian crash just to the north of this intersection over the last three years, which was a result of a pedestrian crossing the roadway at an unmarked location.

- *Holmes Road:* There is a crosswalk across Holmes Road, but it is not part of the signalized intersection. There is no other crossing at this intersection, and sidewalks exist on both sides of Route 7/20. A new pedestrian crossing should be considered across Route 7/20, at least on the northerly side of the intersection. New crossings should be incorporated as part of the signalized intersection so that protected pedestrian phases are provided.

- *Center at Lenox:* There is a signalized crossing across Route 7/20 on the southerly side of the intersection. There are also two other pedestrian crossings at this intersection and on each of the side streets; however, they are not included as part of the traffic signal and are not protected movements. Providing a protected movement for pedestrians to cross Route 7/20 is the most important pedestrian movement at this location. However, with the redevelopment of the Center at Lenox, the intersection should be closely monitored to determine if an additional crossing is needed on the northerly side of the intersection and if the two unprotected crossings need to be protected and included as part of the signal. Future monitoring should determine if there are pedestrians crossing just to the north of the intersection and at unmarked locations, and if providing a new crossing on the northerly side of the intersection would provide a safer crossing for pedestrians.

Evaluation: MassDOT currently owns and maintains the signalized intersections along the corridor, and have indicated that they will further evaluate and monitor these locations to determine the most appropriate improvement measure to address.

6.2.6 Signalized Intersection Timing and Phasing Adjustments

There are not expected to be significant capacity issues along the Route 7/20 corridor. While individual movements may experience a decline in operation due to localized development and general traffic growth, the signalized intersections along the corridor as a whole are expected to provide an acceptable level of service (LOS C or better) to the year 2020. The following provides an overview of options for resolving the operational issues that have been observed. While some of the movements mentioned operate at an acceptable LOS, modifications could be needed to correct safety issues.

Holmes Road Signal

Route 7/20 and Holmes Road intersect to form a fully actuated signalized three-way intersection. This intersection had the highest number of intersection-oriented crashes with a total of 23 crashes. Of the crashes occurring at the Holmes Road intersection, approximately 40-percent of all crashes at this intersection involved vehicles attempting to make a left turn from Route 7/20 southbound onto Holmes Road. This may suggest issues with the signal phasing and timings as well as high vehicle operating speeds in the northbound direction. Overall, the number of angled-type crashes could suggest that the current protected-permissive phasing for the southbound left-turn movement should be increased. The following two options could be considered at this intersection.

- ***Option 1 – Signal Timing Adjustments:*** The current protected phase for the southbound left-turn movement provides 7 seconds of green time with a 5 second clearance interval (3 seconds of yellow time and 2 seconds of all red time). Providing additional green time to the protected phase would allow a greater opportunity for the left-turn queue to clear prior to northbound traffic being released, which could reduce the need for aggressive turning maneuvers during the permissive phase. This adjustment would have a negligible impact to the LOS at this intersection.

- ***Option 2 – Signal Phasing Adjustments:*** Restricting left-turn movements to protected-only would provide for safer operations at the cost of increased delays and queues for left-turning vehicles. If protected-only phasing were implemented it is expected that the existing left-turn lane storage bay may need to be extended to accommodate the future 95th percentile queue.

Evaluation: MassDOT has been closely monitoring this intersection, and will continue to monitor and evaluate improvement alternatives to determine the most appropriate improvement measure to address.

Center at Lenox Signal

Based on this study's future conditions analysis (for the year 2020), the Center at Lenox intersection is expected to operate at an overall LOS C during the weekday evening peak hour, and at an overall LOS B during the Saturday midday peak hour. While this is an acceptable LOS, the operating conditions of the traffic exiting the Center at Lenox during the weekday evening and Saturday midday peak hours, is expected to a LOS F and LOS D, respectively. More importantly, vehicle queues are expected to extend to over 200-feet. The Center at Lenox is currently being redeveloped; however, a vehicle queue of 200-feet could impact the on-site circulation. This assumes that no signal timings would be made following construction.

Evaluation: According to the permits issued for the project, under MEPA, traffic monitoring will be included following construction and occupancy. At that time, it may be determined that minor signal timing adjustments be made to accommodate the future traffic volumes. The proponent has committed to this monitoring plan and will be coordinating with MassDOT in the future.

6.2.7 Driveway Consolidation

At a minimum, properties that have two full access curb cuts on the corridor should be reviewed in greater detail to see if the curb cuts can be consolidated into one, or consolidated with an abutting property, or reconfigured to accommodate one entrance and one exit driveway, or if one of the driveways could be eliminated. In addition, opportunities for connecting parcels through driveways between properties, or interconnecting driveways, should be explored. Improving access by limiting curb cuts would improve safety along the corridor. However, driveway modifications would likely be voluntary by the property owner unless a property was under the local or state permitting review process. In addition, legal cross access agreements may need to be in place between two property owners to facilitate these improvements. The following section lists some of the more critical areas where access could be managed better; based on existing characteristics of adjacent properties and off-site traffic conditions. This summary divides the corridor into three sections, which is based on the spacing of the signalized intersections.

New Lenox Road to Holmes Road

- *Luau Hale Restaurant:* There are two full access driveways to this property, and both are within the area of influence of the signalized intersection of New Lenox Road. Consideration to restricting access to these driveways as a right-turn in and out only, along with providing an interconnecting driveway to the car wash property to the south, would improve safety along the corridor. It should be noted that the car wash access to Route 7/20 is signalized.

- *Different Drummer Kitchen:* There are two full access driveways to this property, and both are within the influence of the signalized intersection of New Lenox Road. Consideration to restricting access to these driveways as a right-turn in and out only would improve safety along the corridor. Full access to the site would be maintained via the driveway off New Lenox Road.

- *Mobil Gas Station:* Based on the configuration of the fueling positions, the southerly driveway should be striped as an entrance only, while the northerly driveway should be striped as a right-turn out only. The restriction on the northerly driveway is due to the close proximity to the Holmes Road traffic signal, and the likelihood that queued vehicles block the light of sight for vehicles turning left.

Holmes Road to Center at Lenox

- *Essentials Salon:* The driveway closest to the intersection of Holmes Road, and on the westerly side of the roadway should either be eliminated or restricted to a right-turn in only. This recommendation is based on the fact that it is located within the influence of the intersection. Also, allowing right-turn movements out could lead to drivers attempting to get into the left-turn lane at the Holmes Road signal, which would require vehicles to navigate crossing two lanes of traffic and merging into the left-turn lane over a distance that is approximately 100-feet.

- *Yankee Candle Store and Yankee Inn:* The southerly driveway to the Yankee Candle store and the northerly driveway to the Yankee Inn appear to be a viable location for consolidation. It appears that these two driveways could function well if consolidated and operating as an exit only. However, parking and truck access/circulation for deliveries would need to be considered.

- *Wagon Wheel Motel:* It appears that each of these driveways could be easily striped to function as an entrance and exit only driveway. Given the location of other driveways to adjacent to this property, a counterclockwise site circulation pattern may work best. This would provide further separation of entering and exiting traffic onto Route 7/20.

Center at Lenox to Dan Fox Dr

- *Burger King and Laundromat:* The driveway closest to the Holmeswood Terrace intersections could be eliminated and the driveway just to the north of this location could be restricted to a right-turn out only. The property currently has full access via Holmeswood Terrace and the traffic signal at the Center at Lenox.

- *Panda House Restaurant:* The existing driveway to this restaurant is significantly wide with parking close to Route 7/20. To maximize parking on the site, either one full access curb cut could be considered, or two curb cuts with an entrance and exit lane only. It appears that an interconnecting driveway may be feasible between this property and the Burger King; however, this would need to be reviewed in greater detail to determine if the drive-thru lane would be impacted as result. This interconnection would provide access to the signalized intersection at the Center at Lenox.

- *Garden Center:* There are three driveways that are adjacent to each other which include an exit driveway from Guidos, a full access driveway leading to the Garden Center, and a driveway that appears to be functioning as an entrance driveway to the BP gas station. Given the change in grade between these three parcels, there appears to be a limited opportunity to consolidate. However, eliminating the Garden Center driveway and creating a reverse frontage roadway behind the Guidos restaurant may help alleviate this driveway configuration. More details on this reverse frontage road are discussed in the next section.

- *Shell Station (Dunkin Donuts):* It appears that given the location of adjacent properties, and the configuration of the existing shell station, the two full access driveways to this parcel could be consolidated to one and located directly opposite the Guidos/Pittsfield Rye Company entrance driveway. However, the access/circulation for the delivery of gasoline trucks would need to be considered, in which case the two existing driveways may be best to operate as a one-way entrance (southerly drive) and exit (northerly) configuration.

Evaluation: The corridor has a significant number of curb cuts that are spaced very closely to each other. Due to the fact that most parcels are small, which limits the ability to modify access without significantly impacting parking or on-site circulation, it was determined that a set of guidelines need to be developed to improve access when parcels are planned to be developed or redeveloped. Therefore, in the final chapter, modifications of the current zoning regulations for the study area corridor will be reviewed. The intent is to develop an access management plan through new zoning that can be enforced during the local permitting process.

6.2.8 Frontage Roadways

The segment of Route 7/20 between Center at Lenox and Stop & Shop (or Dan Fox Drive) has the highest density of curb-cuts along the entire study area corridor. As a result, there were a total of 27 crashes, which resulted in a crash rate for this 1,585 foot segment of roadway to be 3.99, which is significantly higher than the statewide average of 2.30. The majority of crashes in this area involved vehicles turning to/from driveways and making lane changes, which is consistent with a corridor that has a high density of curb cuts. Also, based on the gap data that was collected as part of this study, it was noted that drivers exiting the driveways are acting in a more aggressive manner in order to maneuver across multiple lanes of traffic. The aggressive behavior noted includes using shorter gaps in the traffic stream to pull out of driveways as well as utilizing the center turn lane as an acceleration lane when making a left-turn and merging into traffic.

Secondary roadways typically parallel an arterial roadway and are used to limit direct access to the arterial by allowing direct access from parcel to parcel. The goal of these treatments would be to reduce the number of access points directly to the study area corridor through the creation of other roadways. Two types of secondary roadways were discussed in the previous chapter, frontage roads and reverse frontage roads. While a frontage road could not be applied to the corridor unless several parcels were redeveloped, a reverse frontage road was considered at the back of the parcels adjacent to Route 7/20 and between the Center at Lenox property and the Stop & Shop property.

This option would result in the construction of a roadway that would connect the following properties: North's Service Center, The Lenox Inn, jiffy lube, BP Gas, the garden center, Guidos, Pittsfield Rye Company and Stop & Shop. The proposed roadway could allow for most parcels on the westerly side of the roadway to access the corridor via the Center at Lenox or Dan Fox Drive signalized intersection. This roadway could also allow for the closure or reconfiguration of several curb-cuts along Route 7/20. By isolating turning maneuvers fewer conflict points would exist, thus improving vehicle safety.

Evaluation: A reverse frontage road would be more effective if it were combined with the construction of a raised median. It was determined that while this is a desirable alternative, time and budget constraints restricted this alternative to be fully analyzed in the final chapter.

6.3 Selected Improvements

Phase 2 of this study was originally expected to focus on the design of one or more infrastructure improvements. However, through this planning process it was decided that Phase 2 would be more effective if three of the improvements described above were evaluated in greater detail to gain a better understanding of the feasibility. Therefore, through several meetings with the study management committee, the following improvements were studied in greater detail as described in the next chapter.

- *West Mountain Road Realignment:* it was determined that the realignment of West Mountain Road with the intersection of New Lenox Road would provide an opportunity to improve access along the corridor while providing the opportunity to encourage economic development.

- *Raised Median:* it was determined that this alternative had been considered in the past but the true benefits, operational impacts, right-of-way requirements, and costs associated with constructing a raised median had not yet been determined; therefore, they are explored in more detail in this study.

- *Corridor Overlay District/Zoning Regulations:* it was determined that new zoning regulations could be applied to the corridor to encourage or require corridor access improvements associated with future development or redevelopment activities. Therefore, a new corridor overlay zoning district would be the most effective way to preserve future mobility and plan for the improvements that have been identified as part of this study.

7

Corridor Action Plan

This Chapter summarizes an action plan for the Route 7/20 Access Management Study. This action plan was developed through the collaborative review of existing and future characteristics of the corridor between the Study Management Committee and VHB.

It is important to note that there were several challenges (right-of-way, construction cost, business impacts, etc.) that were presented as part of this study that limited the application of certain access management techniques. This corridor action plan focuses on three improvements that are aimed to improve access and mobility along the corridor. However, further study and coordination with key stakeholders will be needed to implement these improvements. The goal of this chapter is to present key findings of each plan. The following provides a brief overview of each of the three plans.

1. *West Mountain Road Realignment:* the realignment of West Mountain Road would provide an opportunity for adjacent properties to redevelop by creating a safer access to Route 7/20 via the underutilized traffic signal at New Lenox Road.

2. *Raised Median:* the installation of a raised median from Holmes Road to Dan Fox Drive would provide improved safety along the corridor and improve mobility. However, this plan is expected to require additional right-of-way from adjacent businesses owners and could significantly impact adjacent off-street parking and utilities. In addition, environmental impacts could be expected with the installation of u-turn at the Holmes Road and Dan Fox Drive traffic signals.

3. *Access Management Regulation:* The implementation of a new zoning bylaw would replace all current zoning for the corridor in both Lenox and Pittsfield. This is aimed to improve mobility and access to adjacent properties along Route 7/20 between Dan Fox Drive and New Lenox Road.

7.1 West Mountain Road Realignment

7.1.1 Overview

Two alternatives were developed for consideration in realigning West Mountain Road with Route 7 and 20 at New Lenox Road. The overall intent is to re-align West Mountain Road with New Lenox Road to create a four-way intersection, and modify the current West Mountain/Route 7/20 intersection to a right in and right out only intersection. The right in and right out movements at this intersection would be enforced by the installation of a raised median on Route 7/20. This assessment assumes that a raised median could be installed without altering the cross section of Route 7/20; i.e. maintaining existing shoulder and travel lane widths. In addition, the re-alignment of West Mountain Road is aligned through parcels owned by the same individual with the intent of making this land more valuable for development and redevelopment through improved access. These alternatives have been prepared using GIS information and aerial photography, and as such should be considered conceptual until more detailed survey is available to verify the information presented in this section. These alternatives are illustrated in Figures 7-1 and 7-2. Both alternatives maintain a portion of the existing West Mountain Road alignment.

The following provides a quick description of each alternative:

- *Alternative 1:* Provides the most direct alignment to Route 7/20 from approximately 500 feet west of David Road to Route 7/20. The grades along the roadway profile are expected to be greater that Alternative 2 due to the topography of the land and straight line alignment. This alternative would divide the large parcel into a 3.0 acre commercially zoned parcel close to the 7/20 corridor and a 6.9 acre area closer to the residential neighborhood that could support up to six residential parcels.

- *Alternative 2:* Provides a roadway alignment with a gentle curve to Route 7/20 from approximately 250 feet west of David Road. This roadway follows the existing topography, so the grades are expected to be less than Alternative 1. This alternative would have a 3.9 acre commercial parcel on the southerly side of the new alignment with an increased buffer between the neighborhood and the new alignment, and a 7.0 acre area that could support up to six residential parcels.

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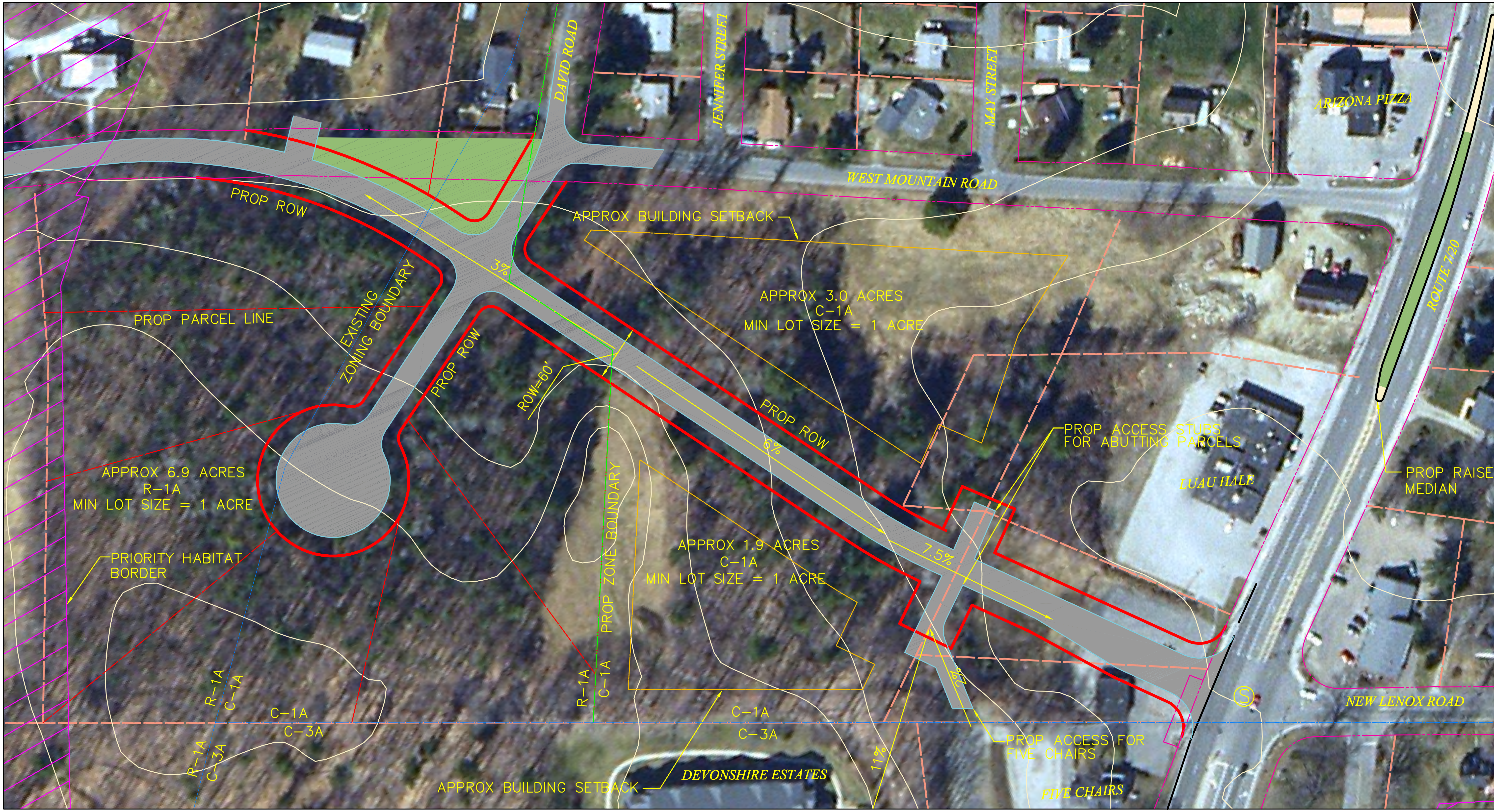

LEGEND

NHESP	
Parcel Line (Existing)	
Parcel Line (Proposed)	
Downgrade	X%
Existing ROW	
Proposed ROW	
Existing Zoning Line	
Proposed Zoning Line	
Traffic Signal	S

0 50 100 Feet

Vanasse Hangen Brustlin, Inc.

Figure 7-1

Conceptual Layout - Alternative 1
West Mountain Road
Route 7/20 Corridor
Access Management Plan

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LEGEND

NHESP		Existing Zoning Line	
Parcel Line (Existing)		Proposed Zoning Line	
Parcel Line (Proposed)		Traffic Signal	S
Downgrade	X%		
Existing ROW			
Proposed ROW			

0 50 100 Feet

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Figure 7-2

Conceptual Layout - Alternative 2
West Mountain Road
Route 7/20 Corridor
Access Management Plan

In addition to providing a new roadway alignment and connection of West Mountain Road to Route 7 and 20, these alternatives have been prepared illustrate how new parcels of land could be established along the new alignment and how they could be developed using current zoning. Although it should be noted that the residential/commercial zoning boundary may need to be altered so that one acre minimum lot sizes can be provided in the residential area. Intersecting driveways linking existing and new commercial parcels have been located along the new alignment in a manner to best suit the new parcels and other developed parcels in the area. Interconnecting driveways would provide an opportunity to reduce vehicle conflicts at unsignalized driveways along Route 7/20.

To create the new intersection of West Mountain Road with Route 7/20, the existing carwash may need to be eliminated under both alternatives as direct access to this building may not be viable due to the roadway location. Also, the building itself may be impacted by grading and the proposed right-of-way for the new alignment. In both alternatives the new roadway has been aligned so that it is perpendicular to Route 7/20 and directly across from New Lenox Road. It should be noted that the existing westbound approach to this intersection, which serves the carwash and Five Chair restaurant, is not perpendicular to Route 7/20. The West Mountain roadway approach width is shown to accommodate a three lane cross section (two lanes exiting and one lane entering) that would also include sidewalks along both sides of the roadway. This alignment would likely require modifications to the existing traffic signal heads on Route 7 and 20 for proper visibility and the existing signal pole foundations would be impacted.

The following provides more specific details for each alternative.

7.1.2 Alternative 1

Alternative 1 is shown in Figure 7-1, and when traveling west to east along the West Mountain Road from the western property line, the roadway would gradually turn to the south intersecting Route 7/20 approximately 400-feet south of where West Mountain Road intersects today. The new alignment length would total approximately 1,500 feet. This is 200 feet longer that Alternative 2 and is a result of utilizing less of the existing West Mountain Road alignment and shifting the new alignment further west of David Road. David Road from the north would be extended to the new roadway and would create two unsignalized intersections within 200 feet of each other; one with the new alignment of West Mountain Road, and one with the existing alignment. A portion of West Mountain Road west of David Road would be eliminated and landscaped, and approximately 900 feet of the existing West Mountain Road alignment west of Route 7/20 would remain.

In order to optimize development potential, the existing zoning line representing the border between the C-1A and R-1A zoning districts would be shifted to the east to provide approximately 6.9 acres total of developable residential area. Current zoning requires a minimum of one acre parcels, and six one-acre parcels appear to be feasible. A cul-de-sac roadway has been conceptually shown to demonstrate how this parcel could be subdivided, and the cul-de-sac roadway would intersect the new alignment at a four-way intersection across from David Road. It is important to note that a small portion of the westerly edge of this residential area has been identified a priority habitat for rare species, and further environmental studies will be needed to verify impact and development potential of this area.

The proposed commercial parcel to be located to the south of the existing West Mountain Road could total approximately 3-acres on what appears to be somewhat level land. However the 1.9 acre commercial parcel proposed for the south side of the proposed roadway may require extensive excavation to redevelop this area. The Five Chairs restaurant, Luau Hale restaurant, and Devonshire Estates could have the ability to access the new roadway via a shared interconnecting driveway.

The following presents some pros and cons for this alternative:

Pros

- *Converts the existing West Mountain Road full access driveway to a right-turn in and out only.*
- *Provides a signalized four-way intersection of Route 7/20, New Lenox Road and West Mountain Road (new alignment) to better control traffic movements between these roadways.*
- *Provides an opportunity for commercial properties to have a long straight visible frontage along the re-aligned West Mountain Road.*
- *Provides an opportunity for a new large 3-acre commercially zoned parcel off the re-aligned West Mountain Road on relatively level ground that could require limited earthwork.*
- *Limits intersecting roadways to two unsignalized intersections that can provide access to several parcels.*
- *Provides access to adjacent properties through interconnecting driveways.*

Cons

- *May require extensive earthwork to develop roadway.*
- *Limits development potential on the southerly side of new roadway, and places most commercial development opportunities on the north side of the roadway adjacent to the current residential property.*
- *Direct alignment to Route 7/20 creates a roadway with greater grades than Alternative 2, which could promote higher vehicle speeds.*
- *Creates two closely spaced intersections with David Road.*

7.1.3 Alternative 2

Alternative 2 is shown in Figure 7-2, and when traveling west to east along the West Mountain Road from the western property line, the roadway turns more abruptly to the south than Alternative 1. This is a result of the roadway following existing contours of the land resulting in a roadway that is not as steep as Alternative 1. The new alignment length would total approximately 1,300 feet. This is 200 feet less that Alternative 1, which is a result of utilizing more of the existing West Mountain Road alignment and shifting the new alignment closer to David Road. David Road and Jennifer Street would need to be extended to the new roadway, while the existing West Mountain Road would be aligned to intersect perpendicular to the new roadway. Due to the realignment, the existing portion of West Mountain Road between May Street and Jennifer Street would need be discontinued and landscaped, and approximately 450 feet of the existing West Mountain Road alignment would remain.

In order to optimize development potential, the existing zoning line representing the border between the C-1A and R-1A zoning districts would be shifted to the east to provide approximately 7.0 acres total of developable residential area. Current zoning requires a minimum of one acre parcels, and similar to Alternative 1, six one-acre parcels appear to be feasible. A cul-de-sac roadway has been conceptually shown to demonstrate how this parcel could be subdivided, and the cul-de-sac roadway would intersect the new alignment at a “T” type intersection just to the west of David Road. Similar to Alternative 1, there is a small portion of the westerly edge of this residential area has been identified a priority habitat for rare species, and further environmental studies will be needed to verify impact and development potential of this area.

The existing commercial parcel located to the south of the existing West Mountain Road could total approximately 1.3-acres, which is significantly less than Alternative 1. The 3.9 acre parcel on the south side of the proposed roadway may still require extensive excavation but there is more developable potential across the frontage of the new roadway. Similar to Alternative 1, the

Five Chairs restaurant, Luau Hale restaurant, and Devonshire Estates could have the ability to access the new roadway via a shared interconnecting driveway.

Pros

- *Converts the existing West Mountain Road full access driveway to a right-turn in and out only.*
- *Provides a signalized four-way intersection of 7/20, New Lenox Road and West Mountain Road to better control traffic movements between these roadways*
- *Provides an opportunity for the 3.9 acre parcel on the south side of the new alignment to have a long frontage with direct visibility to Route 7/20.*
- *Roadway is slightly curved to help reduce vehicle speeds and lesser grades than Alternative 1.*
- *Provides access to adjacent properties through interconnecting driveways.*

Cons

- *The 3.9-acre commercial area south of roadway would require significant earthwork and clearing to make entire site usable.*
- *Roadway alignment uses sharper curvature, which will likely require additional right of way to maintain sight distances at proposed driveways.*
- *More driveways are created as a result of this alignment, three more curb cuts than Alternative 1.*

7.1.4 Traffic Impacts

As stated previously, the realignment of West Mountain Road will open up areas for potential development. With this in mind a preliminary traffic analysis has been conducted for the reconfigured signalized intersection at Route 7/20 with New Lenox Road and West Mountain Road. Based on trip generation rates contained in the Institute of Transportation Engineer's (ITE) *Trip Generation, 8th Edition* a general range of potential uses and sizes was determined. In order to maintain acceptable traffic operations at this intersection it was determined that any additional traffic should not reduce the overall level-of-service (LOS) at the intersection to below LOS C.

Assuming a trip distribution of 50 percent to the north and 50 percent to the south, it was determined that any new development should limit the total number of new exiting trips from West Mountain Road to approximately 160 during the weekday evening peak hour. This estimate could vary somewhat depending on traffic growth along the corridor and how existing travel patterns in and out of West Mountain Road and the uses surrounding it change with the realignment and access to a signalized intersection.

This number of trips could equate to a wide variety and combination of uses. Table 7-1 provides a general summary of uses, sizes and number of evening peak hour trips they would be estimated to generate.

Table 7-1
Trip Generation for Potential Land Uses

Land Use	Size	Weekday Evening Peak Hour Trips Entering	Weekday Evening Peak Hour Trips Exiting
Office Building (LUC 710)	100 ksf	35	160
Medical-Dental Office Building (LUC 720)	75 ksf	60	160
General Retail (LUC 820)	35 ksf	155	160
Supermarket (LUC 850)	30 ksf	165	160
Drive-in Bank (LUC 912)	12 ksf	165	160
Quality Restaurant (LUC 931)	65 ksf	325	160
High-Turnover Restaurant (LUC 932)	35 ksf	230	160

Note: Based on trip generation rates for land use codes (LUC) contained in *Trip Generation, 8th Edition* by ITE.

7.1.5 Conceptual Construction Cost Estimates

This section presents an estimated cost for each of the alternatives. Cross-sectional treatments, intersection improvements, and sidewalks are included. The following provides an "order of magnitude" cost estimate for the two alternatives, which are meant to be used as a guideline for future funding needs. More detailed cost estimates for the realignment cannot be determined at this stage until the area is surveyed. *It should be noted that the construction cost estimates do not take into consideration the following: cost to construct interconnecting driveways or cul-de-sac roadways, and property, business and building acquisitions.* Construction costs for both alternatives are summarized in Table 7-2.

Table 7-2
Conceptual Cost Estimate Summary

Items	Estimated Cost	
	Alternative 1	**Alternative 2**
Full Depth Widening	$338,100	$282,900
Cold Plane and Overlay Pavement	$22,400	$28,000
Concrete Sidewalks and Driveways	$74,800	$68,000
Unclassified and Earth Excavation	$30,150	$21,000
Loam Borrow & Seed	$30,000	$22,200
Granite Curb	$140,250	$136,750
New Lenox Road Traffic Signal Modifications	$200,000	$200,000
Route 7/20 Median in front of West Mountain Road	$20,000	$20,000
Storm Water Drainage Modifications	$150,500	$153,500
Sanitary Sewer Modifications	$80,000	$95,000
Streetlights and Conduit	$370,000	$370,000
Water Modifications	$78,750	$52,000
Miscellaneous (signs, markings, clearing/grubbing, wheelchair ramps, etc.)	$38,380	$28,800
2010 Construction Sub Total	**$1,573,330**	**$1,478,150**
Police, Mobilization and Construction Oversight (16%)	$251,733	$236,504
Contingency (20%)	$314,666	$295,630
2010 Contingency Sub Total	**$566,399**	**$532,134**
Permitting, Survey & Design (15%)	**$236,000**	**$221,723**
2010 Design Sub Total	**$236,000**	**$221,723**
2010 Construction Total	**$2,375,728**	**$2,232,007**
2020 Construction Total*	**$3,192,780**	**$2,999,630**
*(Assumes 3% annual inflation over 10-years)		

Note: Estimates do not include right-of-way takings, utility relocation, as-built surveys, easements, or any environmental mitigation.

7.2 Raised Median

During the preparation of this study it was determined that a raised median along Route 7/20 between Holmes Road and Dan Fox Drive is a viable future improvement alternative that could improve safety and improve mobility along this principal arterial. To better prepare for the potential of adding a median in the future, a concept plan showing the potential median location was prepared to provide a better understanding of the infrastructure and right-of-way (ROW) impacts associated with the construction of a raised median.

Through the close coordination with the Study Management Committee, a conceptual median layout plan was prepared on aerial photography with the aid of GIS information, field observations, and roadway information provided by MassDOT. It is important to note that this plan and the findings of this assessment should be considered conceptual until more detailed survey can be obtained.

7.2.1 Overview

A median was first considered for this corridor in 1989 when MassDOT reviewed a series of private development proposals that indicated the corridor would deteriorate at an alarming rate if each development were approved and no infrastructure improvements were proposed. However, it was determined through a public review process that businesses and property owners did not support this idea because a median would limit access to abutting property and impact businesses along the corridor. Therefore, the proposal was not implemented. Following this process an additional through lane was provided in each the northbound and southbound direction to improve capacity and traffic flow, which resulted in the roadway cross section that exists today. In 1988, and during the preparation of MassDOT's original assessment of a median, the corridor averaged annually 24,230 vehicles per day near the Town/City Line[9]. The volumes observed for this access management study, indicate that corridor traffic volumes are less than when the median was evaluated in 1988.

Currently, the corridor incorporates a five lane cross-section, which includes two through lanes in both the northbound and southbound direction and a two-way-left-turn-lane (TWLTL). While a TWLTL can improve access and safety, previous research indicates that a TWLTL becomes less efficient once daily traffic volumes along a corridor reach between 24,000 and 28,000 vehicles per day (vpd)[10]. Today the Route 7/20 corridor carries between 21,000 and 24,000 vpd depending on the time of year. While there are periods where the daily traffic volumes approach the 24,000 vpd TWLTL threshold, the majority of the days in a given year are below this threshold. However, it is important to note that the redevelopment of the Center at Lenox is expected to add an additional 2,700 vpd. The efficiency of the TWLTL is a concern when vehicle crashes along a corridor become more prevalent. The following issues raise key issues that could support the implementation of a raised median:

- Observations indicate that drivers along the corridor are utilizing the TWLTL as an acceleration/deceleration lane when entering and exiting adjacent businesses.

9 Figure 2-5: 1988 AAWDT Traffic Flow Map, Route 7/20: Lee, Lenox, Pittsfield; Corridor Evaluation and Planning Study Short Range Element, Massachusetts Department of Public Works.

10 Access Management Manual, Transportation Research Board of the National Academies, 2003

- The corridor currently has 60 curb cuts, with 44 of these curb cuts located between Holmes Road and Dan Fox Drive. More curb cuts typically mean more conflict points, and as a corridor's curb cut density increases, conflicts increase. This can result in an increase in crashes that compromises safety along a corridor. Implementing a raised median limits vehicle conflicts at each driveway to a right-in and a right-out, which significantly reduces conflict points along the corridor.

- The crash rate between Center at Lenox and Dan Fox Drive, not including the signalized intersections, is approximately 3.99. This is higher than the statewide average of 2.30. It should be noted that the statewide average includes crashes that have occurred on roadways similar to Route 7/20 in urban areas throughout the state, and thus should not be the only statistic taken under consideration. Crash severity, as well as the total number of crashes, should be taken into account.

As a result of previous assessments in this study, which resulted in the issues listed above, it was determined that a median needed to be further reviewed to understand the potential impacts to businesses, potential construction costs, and potential circulation issues. The following was considered as part of this assessment:

- A raised median would consist of constructing a 10-foot wide planted median along Route 7/20 between Holmes Road and Dan Fox Drive.

- A break in the median would be provided only at the existing signalized intersections of Holmes Road, Center at Lenox/Holmeswood Terrace and Dan Fox Drive.

- U-turns for cars would be accommodated at each of the signalized intersections.

- The roadway cross section would need to be widened by approximately 6 to 8 feet to accommodate a raised median, wider shoulders to meet current design standards, two travel lanes in the northbound and southbound directions, sidewalks on both sides of the roadway, and the relocation of utilities.

The impacts of a raised median along this corridor will be significant. Before implementation could occur, the proposed project would need further engineering and environmental analysis, beyond the scope of this planning study, to more accurately quantify the nature and extent of environmental and property impacts. An engineering cost/benefit analysis should be conducted to determine if the proposed benefits outweigh project costs and impacts to the environment and abutting properties.

In addition, strong community support from the City of Pittsfield, the Town of Lenox and from the businesses abutting the highway would be crucial for the project to be successful. The Berkshire MPO should be involved at the planning stage to discuss the proposed project as it relates to the Regional Transportation Plan, the project's priority compared to other regional transportation priorities, and project funding.

7.2.2 Roadway Cross Sections

As previously mentioned, the shoulder widths along the corridor currently do not meet current design standards, and since the corridor is on the National Highway System (NHS), more stringent design standards must be met when future improvements are designed. This means the corridor's cross section will need to include a 2-foot inside shoulder (along the median) and a minimum of 4-feet for the outside shoulder (along the sidewalk). However, it should be noted that for NHS roadways, 8-foot outside shoulders are preferred. Implementing narrower shoulders would require the preparation of a design exception report that would identify the negative impacts associated with 8-foot shoulders and justify 4-foot shoulders. This design exception report would need to be reviewed and approved by the Federal Highway Department (FHWA) and MassDOT.

As part of this study several proposed roadway cross sections were reviewed with the Study Management Committee. These cross sections were compared to the corridor's existing cross section. Figure 7-3 illustrates the existing corridor cross section and four cross sections that were considered during this assessment. It should be noted that cross section three was identified as being the preferred alternative.

- *Cross Section 1:* The existing roadway cross section generally consists of 60 feet curb to curb. This includes 2-foot outside shoulders, 11-foot travel lanes, and a 12-foot TWLTL.

- *Cross Section 2:* This proposed roadway cross section consists of 78-feet curb to curb. This includes 8-foot outside shoulders, 12-foot travel lanes, 2-foot inside travel lanes, and a 10-foot planted median. This proposed cross section could require approximately 18-feet of right-of-way acquisition; however a design exception report for justification is not expected to be needed.

- *Cross Section 3:* This proposed roadway cross section consists of 66-feet curb to curb. This includes 4-foot outside shoulders, 11-foot travel lanes, 2-foot inside travel lanes and a 10-foot planted median. This proposed cross section could require approximately 6-feet of right-of-way acquisition; however a design exception report for justification is expected to be needed to justify a narrower outside shoulder and narrower travel lanes. This is the preferred cross section that was selected by the Study Management Committee.

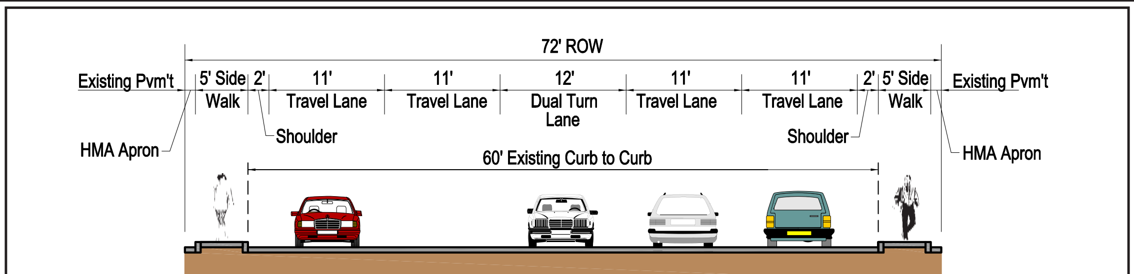
- *Cross Section 4:* This proposed roadway cross section consists of 60-feet curb to curb. This includes 4-foot outside shoulders, 11-foot travel lanes, 2-foot inside travel lanes and a 4-foot cement concrete median. This proposed cross section may not require any right-of-way; however a design exception report for justification is expected to be needed to justify a narrower outside shoulder and narrower travel lanes. However, neither community supports the installation of a concrete median.

- *Cross Section 5:* This proposed roadway cross section consists of 71-feet curb to curb. This includes 4-foot outside shoulders, 11-foot travel lanes, 11-foot turn lanes, 2-foot inside travel lanes and a 4-foot cement concrete median. This proposed cross section was originally prepared to demonstrate the impacts associated with providing a left-turn lane between traffic signals. This may require 11-feet of right-of-way acquisition; however a design exception report for justification is expected to be needed to justify a narrower outside shoulder and narrower travel lanes. This alternative also provides an illustration for the proposed cross section at signalized intersections where turn lanes are already present.

As indicated in the previous section, simply replacing the existing TWLTL and providing a 10-foot median with wider shoulders does not provide enough right-of-way to implement this improvement and as a result additional right-of-way would be needed. While a narrower median could be implemented, thus lessening the impacts along the corridor, the Study Management Committee decided that a wider planted median would be more desired than a narrow concrete median that would provide no aesthetic appeal.

Figures 7-4 through 7-6 provide the layout for a median along the corridor between Holmes Road and Dan Fox Drive.

Roadway Cross Section North of City/Town Line: Existing Conditions

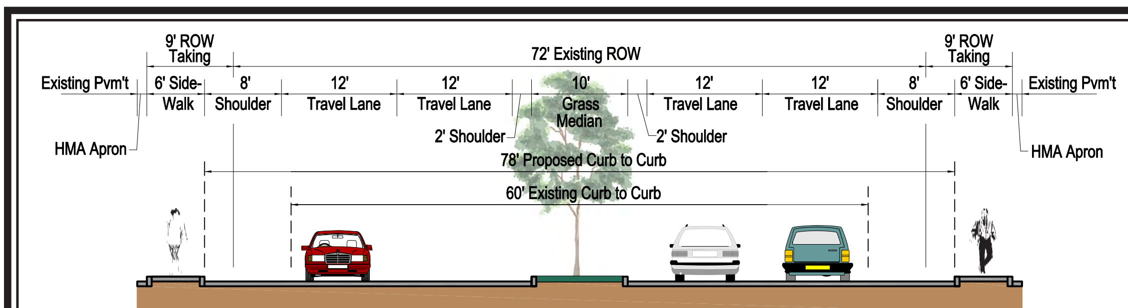


#1: Existing Conditions

Cross Section 1—Existing Conditions Dual Turn Lane

- 11' Lanes
- 12' Dual turn lane
- 2' Shoulders

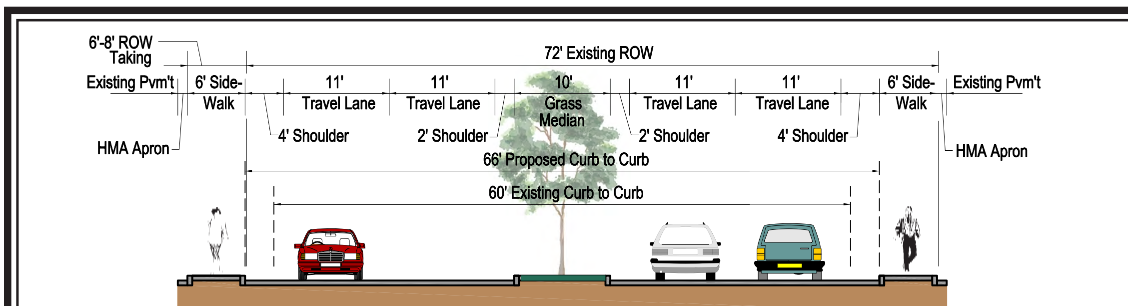
Roadway Cross Section North of City/Town Line: Initial Concepts



#2: 10' Median - No DER w/ ROW takings

Cross Section 2—Grass/Planted Median (no design exception)

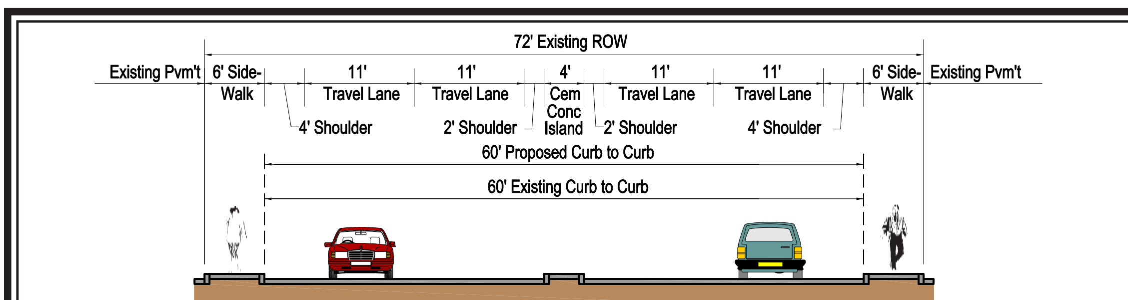
- 12' Lanes
- 10' Median
- 8' Shoulders
- Approx 18' ROW needed



#3: 10' Median - DER w/ ROW takings

Cross Section 3—Grass/Planted Median (design exception)

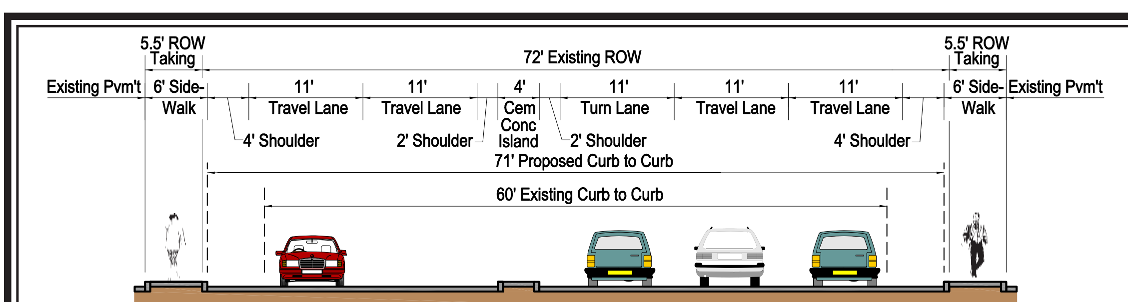
- 11' Lanes
- 10' Median
- 4' Shoulders
- Approx 6' ROW needed



#4: 4' Median - DER w/ No ROW takings

Cross Section 4—Concrete Median (design exception)

- 11' Lanes
- 4' Median
- 4' Shoulders
- No ROW needed



#5: 4' Median - Left Turn Lane - DER w/ ROW takings

Cross Section 5—At Left-turn Lane (design exception with cross section 3 or 4)

- 11' Lanes
- 4' Median
- 11' Left-turn lane
- 4' Shoulders
- Approx 11' ROW needed

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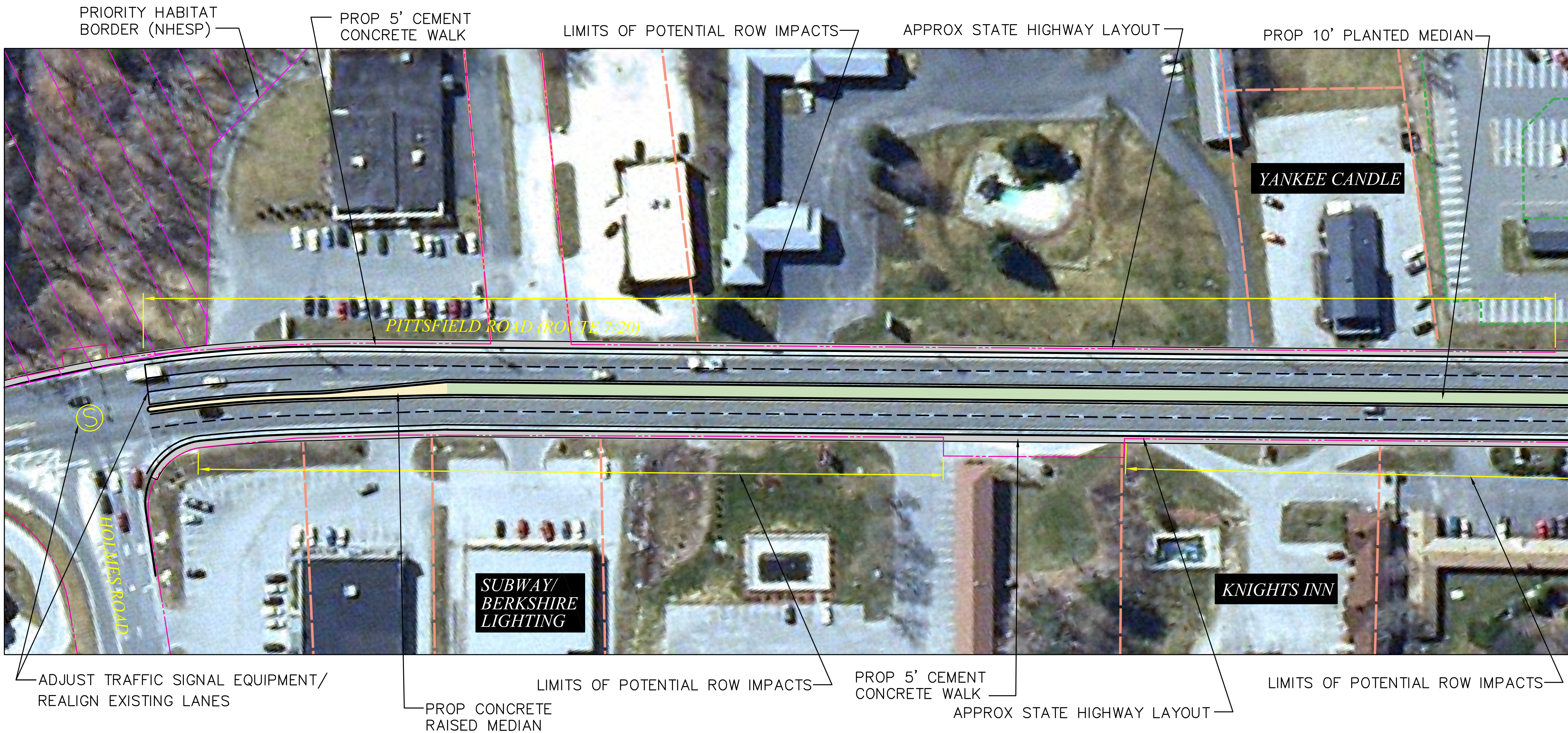
Cross Section Concepts
North of Lenox/Pittsfield Line

Figure 7-3

Route 7/20 Corridor
Access Management Plan



Legend

NHESP/Priority Habitat		Proposed Curb	
Parcel Line (Existing)		Proposed Lane Line	
Approximate ROW (Existing)		ROW	Right-of-Way
Existing Traffic Signal	Ⓢ		
Center at Lenox Redevelopment			

0 40 80 Feet

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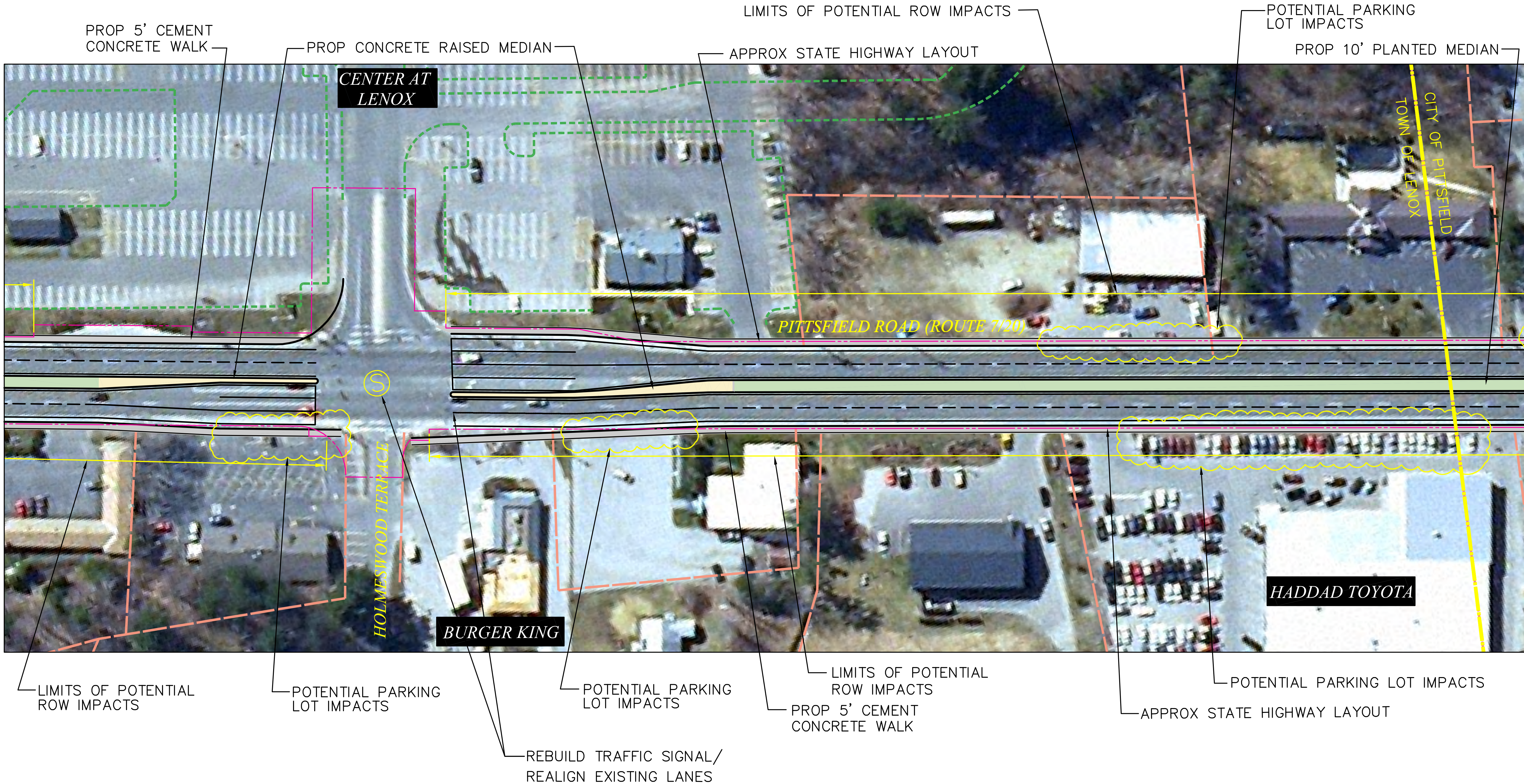
Figure 7-4

Raised Median Concept
Holmes Road to Center at Lenox
Route 7/20 Corridor
Access Management Plan



Legend

NHESP/Priority Habitat		Proposed Curb	
Parcel Line (Existing)		Proposed Lane Line	
Approximate ROW (Existing)		ROW	Right-of-Way
Existing Traffic Signal	Ⓢ		
Center at Lenox Redevelopment			

0 40 80 Feet

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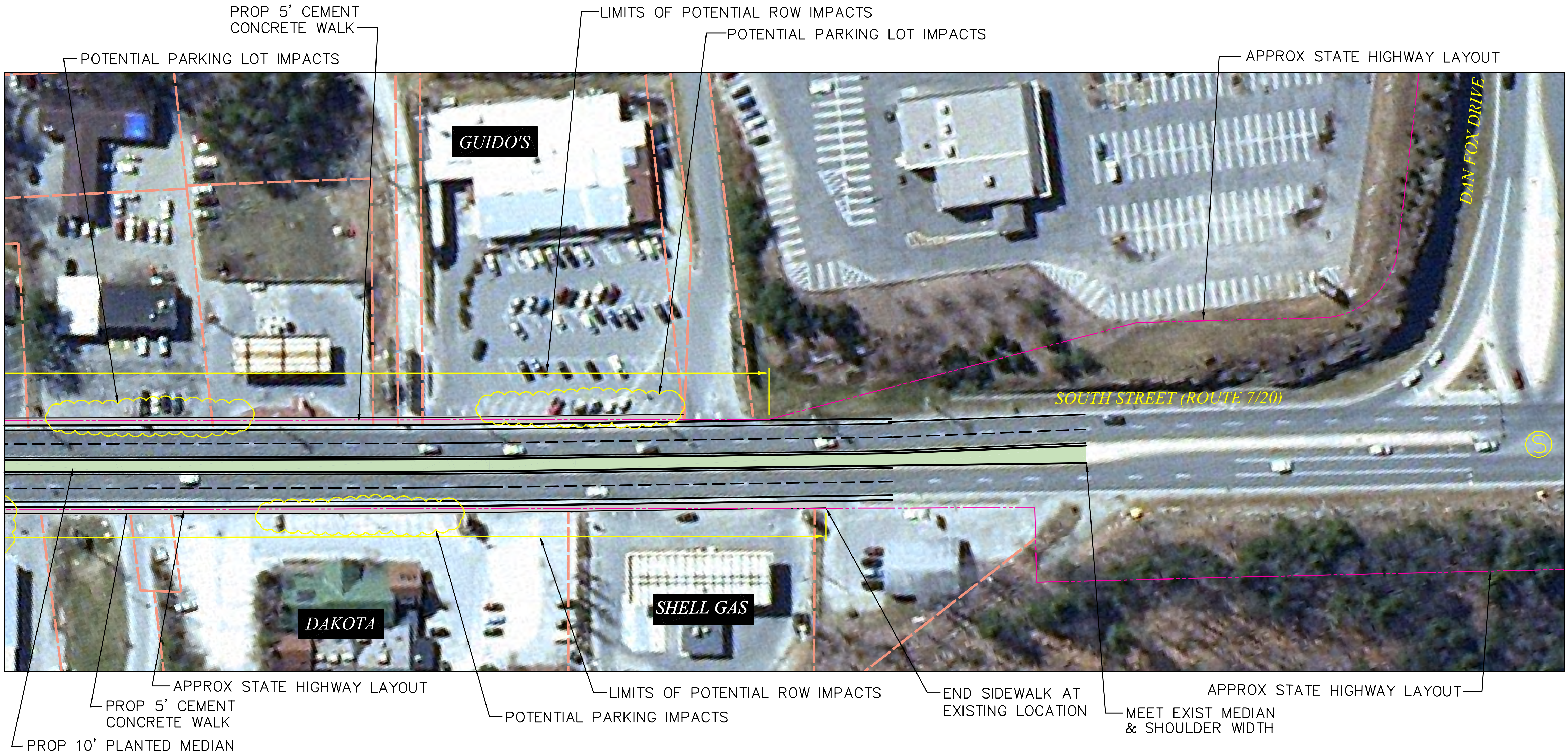
Figure 7-5

Raised Median Concept
Center at Lenox to Town/City Line
Route 7/20 Corridor
Access Management Plan



0 40 80 Feet

Legend

NHESP/Priority Habitat		Proposed Curb	
Parcel Line (Existing)		Proposed Lane Line	
Approximate ROW (Existing)		ROW	Right-of-Way
Existing Traffic Signal	Ⓢ		
Center at Lenox Redevelopment			

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Figure 7-6

Raised Median Concept
City/Town Line to Dan Fox Drive
Route 7/20 Corridor
Access Management Plan

7.2.3 Roadway and Intersection Impacts

Taking into account the preferred roadway cross section from the previous section, the following summarizes key infrastructure impacts along the corridor between Holmes Road and Dan Fox Drive associated with a raised median.

- *Widening:* To maintain the existing roadway alignment, between 2 and 8 feet of widening is expected to occur on both sides of the road; however, this will need to be confirmed when more detailed field survey is readily available.

- *Right-Of-Way:* The southerly segment between Center at Lenox and Holmes Road would require approximately 6,500 square feet of additional right-of-way over 12 parcels. The northerly segment between Center at Lenox and the existing median at Dan Fox Drive is expected to require approximately 9,000 square feet of additional right-of-way over 21 parcels. While the right-of-way impacts seem small in terms of the total square footage along the corridor, these impacts are also expected to impact driveway profiles and require the construction of retaining walls; most of these impacts are expected on the easterly side of the corridor.

- *Utility Impacts:* The median can expect to result in the relocation of approximately 26 utility poles (12 south of Center at Lenox and 14 north of Center at Lenox). Most of these utility poles are private utility companies with poles located on the westerly side of the roadway. The utility company would need to be notified during the design process to confirm the responsibility of the relocated utility as well as making sure that any utility upgrade program that is proposed is taken into account. It should also be noted that there are ten (10) private lights, including eight (8) across the frontage of the Haddad Toyota dealership, which may be impacted.

- *Signage Impacts:* Approximately 13 private signs could be impacted due to the proposed widening to accommodate the median.

- *Parking Impacts:* Widening to accommodate the proposed median could impact parking on several parcels. The largest potential impacts would be along the northerly segment at the Guido's Supermarket (estimated at 13 spaces), Dakota Restaurant (estimated at 18 spaces) and Haddad Toyota (estimated 30 spaces). It is not clear at this point whether this would impact current zoning requirements for required parking spaces or if parking on these properties is currently under utilized.

- *Traffic Signal Impacts:* Widening to accommodate the proposed median could impact the location of the existing traffic signal equipment at Holmes Road and Center at Lenox, as the roadway geometry is expected to shift slightly. As a result, the traffic signal mast arms at Holmes Road may need to be relocated and the intersection of the Center at Lenox may need to be rebuilt as the traffic signal strain pole foundations may be impacted by the roadway widening. Signal timing modifications, and potentially some minor modifications to the triangular island on Dan Fox Drive may be needed to accommodate passenger car u-turns.

Reverse directions for larger trucks is discussed in greater detail in the next section.

7.2.4 Reversing Direction

Installing a median along the corridor would require the investigation of making accommodations for u-turns so that customers and delivery vehicles can reverse direction to access businesses if necessary. As mentioned in the previous section, the presence of multiple lanes in each direction of Route 7/20, along with expanded shoulders, could allow for passenger cars to make u-turns at the signalized intersections. However, separate accommodations would need to be provided to accommodate larger vehicles.

Holmes Road

To the south at Holmes Road, the following two options could be considered to allow larger vehicles to reverse direction.

Option 1: Jughandle

Provide a southbound jughandle on the westerly side of Route 7/20 that would ultimately function as an eastbound leg at this intersection. Providing an additional leg at this intersection would allow for the southbound left-turn lane to be eliminated, and by doing so, any safety concerns of the existing left-turn movements/signal phasing from Route 7 /20 to Holmes Road would be eliminated. However, more detailed survey would be required to determine if this is even feasible due to the presence of wetlands and endangered species (NHESP) in the immediate vicinity of this intersection, as most of this widening appears to occur within a riverfront buffer and very close to the wetland. The turning radius for a truck and passenger car has been graphically shown on Figure 7-7.

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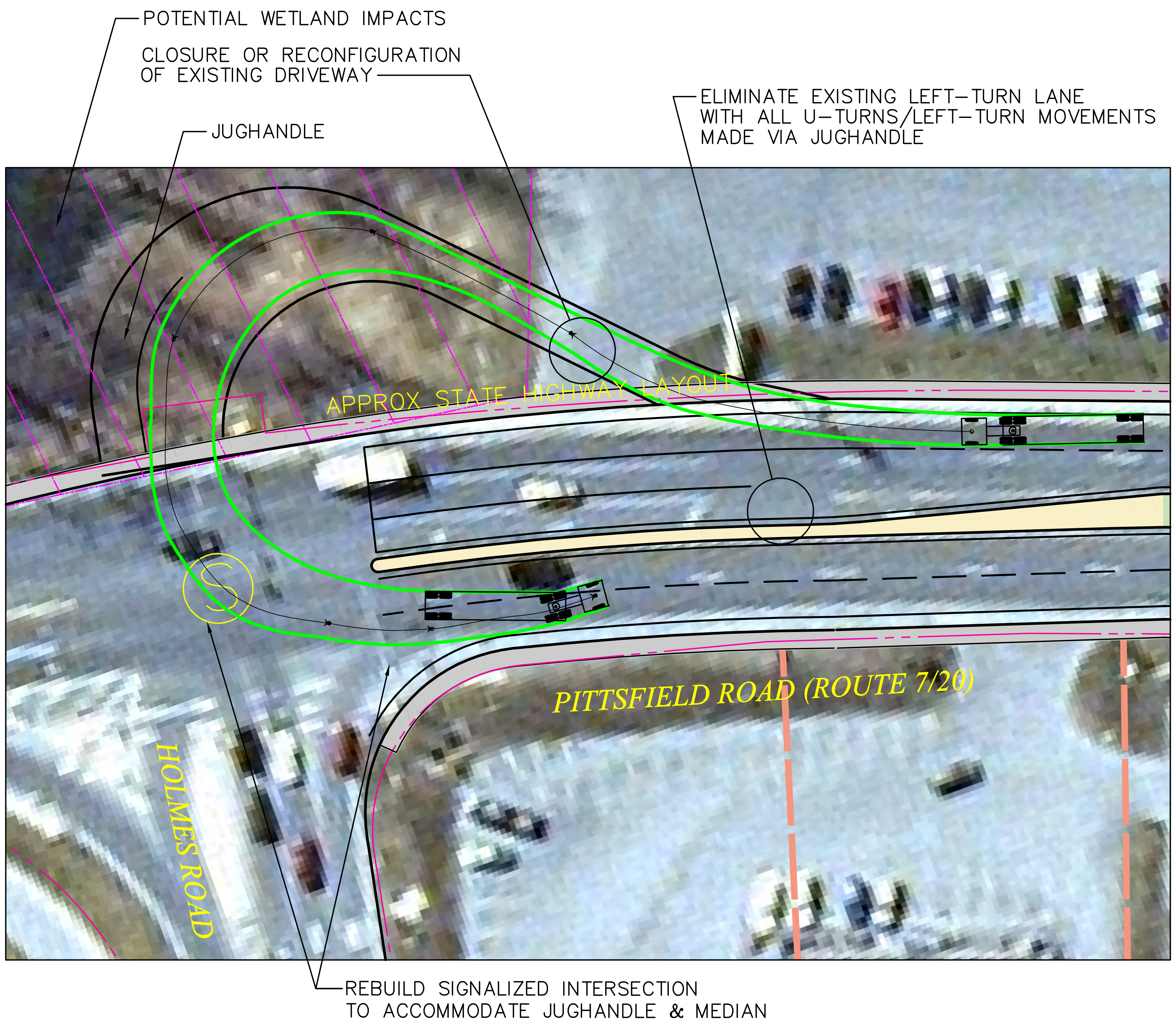
Truck Accommodations



Passenger Car Accommodations

Legend

NHESP/Priority Habitat		Proposed Curb	
Parcel Line (Existing)		Proposed Lane Line	
Approximate ROW		Vehicle Turning Path	
Existing Traffic Signal	Ⓢ		
Center at Lenox Redevelopment			

0 20 40 Feet

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Figure 7-7

Raised Median Concept
Holmes Road Reverse Direction
Route 7/20 Corridor
Access Management Plan

Option 2: West Mountain Road

A second option would be implemented in conjunction with the realignment of one of the West Mountain Road alternatives. Vehicles would be allowed to turn onto the existing West Mountain Road, adjacent to Arizona Pizza, and utilize the newly aligned roadway that would intersect with New Lenox Road. However, this alternative would result in an increase in truck traffic along a portion of West Mountain Road that is predominantly residential.

Center at Lenox

As previously mentioned, the presence of multiple lanes in each direction of Route 7/20 and expanded shoulders could allow for passenger cars to make u-turns at the signalized intersections along the divided corridor, including the intersection at the Center at Lenox. The turning radius for a passenger car at this intersection has been shown graphically in Figure 7-8, and it is assumed that this intersection would only accommodate u-turns for passenger vehicles.

Dan Fox Drive

To the north at Dan Fox Drive, the following two options could be considered to allow larger vehicles to reverse direction. Turning radius for a trucks and passenger cars has been shown graphically in Figure 7-9.

Option 1: Jughandle

Under this scenario the northbound left-turn lane would be removed and a jug-handle would be created on the easterly side of the roadway that would allow all vehicles to reverse direction and access Dan Fox Drive from the south. However, extensive excavation would be required, thus making this option a costly alternative. In addition, the property on the easterly side of the roadway has a conservation restriction placed upon it.

Option 2: Left-Turn Loop

Under this scenario the existing northbound left-turn lane would be used to reverse direction when traveling northbound. However, this would require that the eastbound travel lanes on Dan Fox Drive be shifted to the north so that the turning radius of a larger truck could be accommodated. This shift would impact the Dan Fox Drive median that is present on this approach. The channeled right-turn movement from Dan Fox Drive would become more of a

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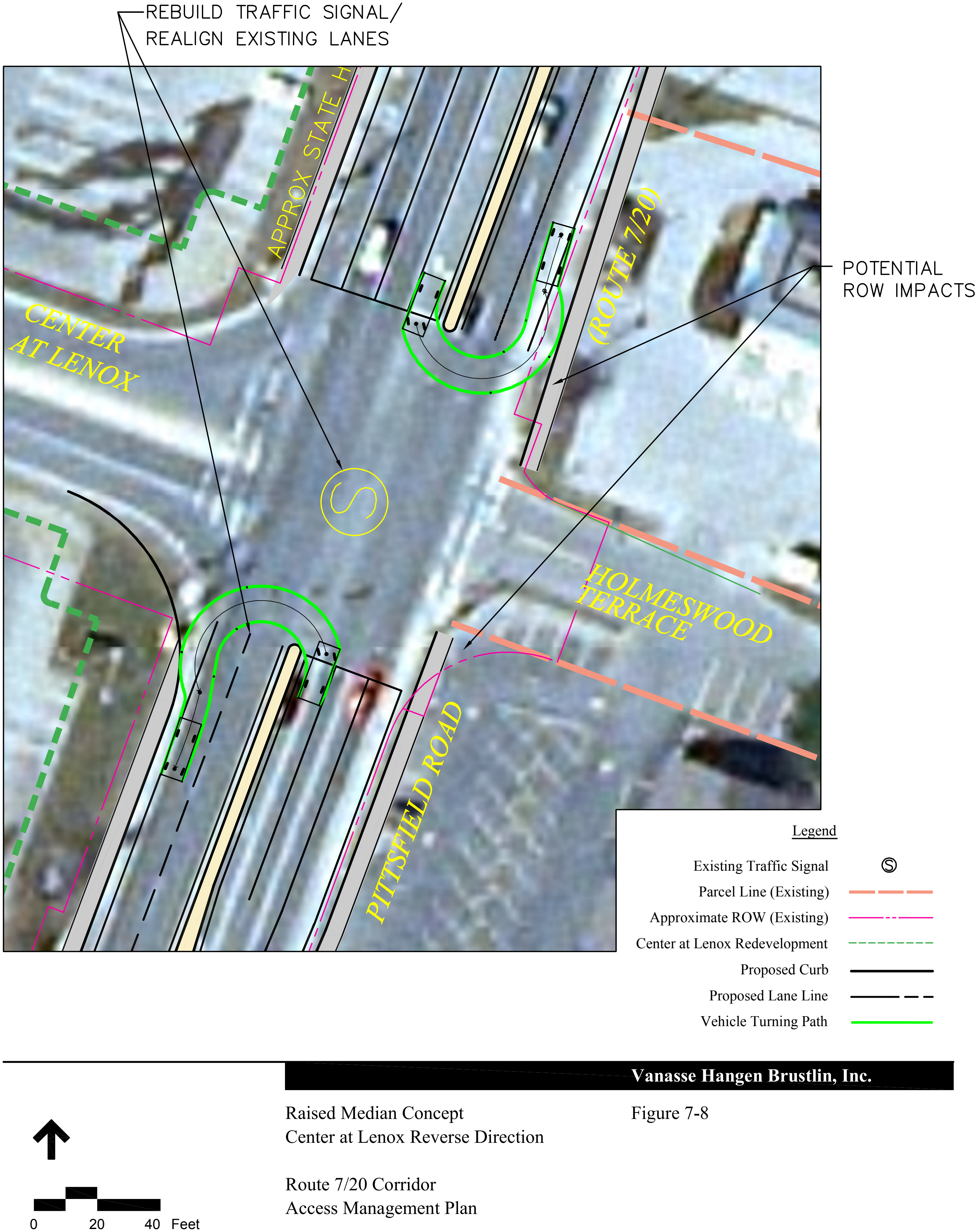

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Raised Median Concept
Center at Lenox Reverse Direction

Figure 7-8

Route 7/20 Corridor
Access Management Plan

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Raised Median Concept
Dan Fox Drive Reverse Direction

Figure 7-9

Route 7/20 Corridor
Access Management Plan

hard right-turn movement with no raised triangular island. This option requires less excavation and right-of-way when compared to *Option 1.* The traffic signal phases may need to be slightly adjusted to provide longer green time for large vehicles to make this maneuver, and it would also require the existing Dan Fox Drive eastbound right-turn phase overlap to be eliminated.

If accommodations are too costly or deemed not feasible, alternative trucking routes for businesses may need to be developed.

7.2.5 Conceptual Construction Cost Estimates

This section presents an estimated cost for the general corridor improvements that are associated with the raised median. Cross-sectional treatments, intersection improvements, sidewalk and streetscape improvements and other corridor improvement strategies are included. The following provides a "conceptual cost estimate" for these improvements, which are meant to be used as a guideline for future planning and funding needs. Specific cost estimates for the improvements cannot be determined at this stage since the limits of the improvements cannot be specifically determined until the corridor is surveyed and the exact location of the property lines/right-of-way is determined.

The following provides a summary of the cost estimate.

Included In Estimate

- *Limits of Work:* The median would be installed from Holmes Road to Dan Fox Drive. The median length is approximately 3,000 feet.

- *Holmes Road intersection:* Traffic signal improvements assume the relocation and adjustment of the traffic signal equipment at Holmes Road to accommodate the realignment of existing travel lanes as a result of constructing the median and implementing the jughandle.

- *Center at Lenox intersection:* Traffic signal improvements assume rebuilding the traffic signal at this location as constructing the median will result in realigning the roadway and potentially impacting the strain pole foundation for the existing traffic signal. The improvements at this intersection are expected to accommodate u-turns for passenger vehicles only.

- *Dan Fox Drive intersection:* traffic signal improvements assume that only minor signal timing changes will be made to accommodate passenger vehicle u-turns, and truck u-turns have been accounted for.

- *Survey and Permitting Costs:* A cost for environmental reports, design, survey and other permitting necessary to implement these improvements has been estimated as a percent of total construction cost.

Not Included In Estimate

- *Right-of-Way:* Right-of-way takings for roadway widening are not included in the estimate. As previously noted, while the right-of-way impacts seem small in terms of the total square footage along the corridor, these impacts are also expected to impact driveway profiles and require the construction of retaining walls. *<u>This is a cost that could significantly increase the overall cost to this treatment.</u>*

- *Business Impacts:* Also, right-of-way impacts do not account costs associated with lost parking spaces to private businesses, reduced property access and value, and other related business costs. *<u>These are costs that could significantly increase the overall cost to this treatment.</u>*

- *Sign and Utility Relocation:* The relocation of signs and street utilities is not included, and it is assumed to be the responsibility of the owner or utility company. New streetlights are also not included. *<u>These are costs that could significant increase the overall cost to this treatment.</u>*

- *Environmental Mitigation:* The costs do not include environmental mitigation required to construct the median or the u-turn areas that are required for the installation of the median.

Table 7-3 provides a more detailed break out of the cost estimate.

Table 7-3
Conceptual Construction Cost Estimate Summary

Items	Cost
Full Depth Roadway Widening	$306,000
Cold Plane and Overlay Pavement	$285,200
Sidewalks, Driveways & Median	$500,000
Saw cut Pavement	$ 24,000
Loam & Seed	$ 38,400
Street Trees	$100,000
Granite Curb	$129,000
Granite Edging	$157,500
Storm Water Drainage Modifications	$500,000
Water Service Modifications	$100,000
Holmes Road Intersection/Signal Modifications (estimated)	$750,000
Center at Lenox Intersection/Signal Modifications (estimated)	$150,000
Dan Fox Drive Intersection/Signal Modifications (estimated)	$750,000
Retaining Walls	$500,000
Miscellaneous (signs & pavement markings)	$ 10,000
2010 Construction Sub Total	**$4,300,100**
Police, Mobilization and Construction Oversight (16%)	$688,016
Contingency (20%)	$860,020
2010 Contingency Sub Total	**$1,548,036**
Permitting, Survey & Design (15%)	$645,015
2010 Design Sub Total	**$645,015**
2010 Construction Total	**$6,493,151**
2020 Construction Total*	**$8,726,252**
*(Assumes 3% annual inflation over 10-years)	

Note: **Estimate does not include right-of-way, business impacts, utility or sign relocations, new street lights, easements, or environmental mitigation associated with improvements.**
* If not constructed using State/Federal funding, this contingency may not be required

7.3 Access Management Regulations

As discussed throughout this study, several parcels adjacent to the corridor have more than one driveway access to the corridor, which create several conflict points over the one-mile study area. Consolidation of these driveways would improve corridor access and safety; however, many of the parcels on the easterly side of the corridor are narrow, and do not provide the depth necessary to interconnect them. In addition, consolidating driveways could have a negative impact on the internal circulation pattern and parking at many of the parcels. The westerly side of the roadway has larger parcels, but still would have a limited opportunity for interconnecting driveways due to current building locations. As a result of past developments not accounting for access management techniques in their layouts, eliminating driveways onto the corridor is not an option unless parcels are redeveloped. Therefore, new regulatory techniques were considered to implement access management techniques when parcels are redeveloped. These regulations are aimed to create opportunities to increase the corridor's right-of-way for future traffic improvements and develop specific design criteria that property owners would need to following when redeveloping a parcel.

Through discussions with the study management committee, it was determined that changes to the existing local zoning codes could effectively guide access management improvements along the corridor. As discussed in Chapter 5, this is best achieved through the creation of a new zoning district that would apply to the study area as opposed to an overlay district where compliance is optional.

The following reviews the application of a revised zoning bylaw.

7.3.1 Route 7/20 Zoning Bylaw

Creating a new zoning bylaw for the study area corridor would allow the municipalities to establish joint and consistent zoning regulations for both communities and incorporate access management techniques. These regulations would set criteria to promote more creative site design, thus applying access management techniques similar to those that have been identified in Chapter 5. This technique would be used to integrate land uses, access and circulation systems to create a unified design for the corridor, ensure that traffic is able to safely and efficiently ingress and egress onto the corridor, and provide for alternative means of access to properties along the corridor.

The proposed new zoning for both communities would establish a new zoning district along the Route 7/20 corridor and allow for a cohesive review and permitting process regardless of whether the project is located in Lenox or Pittsfield. It is anticipated that both municipalities would adopt the new zoning district in order to achieve the access management standards that would be mutually beneficial to both communities. In doing so, it is recognized that some provisions may need to be tailored more specifically to the zoning and planning procedures established previously by either Lenox or Pittsfield, but the important goal is to ensure consistency in the approach of both communities to access management along this corridor.

A draft zoning bylaw for the corridor has been developed, which is included in the Appendix. This zoning bylaw incorporates access management techniques that would need to be applied for any parcel that meets any of the following criteria:

- Results in a structural increase of 2,000 square feet or more;
- Adds ten or more parking spaces; or
- Adds fifty or more new vehicle trips during the peak hour.

If a parcel development or redevelopment triggers any of these thresholds, the following would need to be prepared as part of the site plan approval process that would be required as part of the local permitting process:

- Development of a site plan that identifies specific information suitable for municipal review and assessment of the impacts of the project with respect to on-site circulation, access, and impacts to the corridor; and
- Development of a traffic impact and access study (TIAS) if more than fifty new vehicle trips are generated during the peak hour.

This information would be used by the permitting authority; i.e. the planning board, development board, etc., to ensure that the parcel is complying with the standards contained in the zoning bylaw. The following design standards are included in the bylaw:

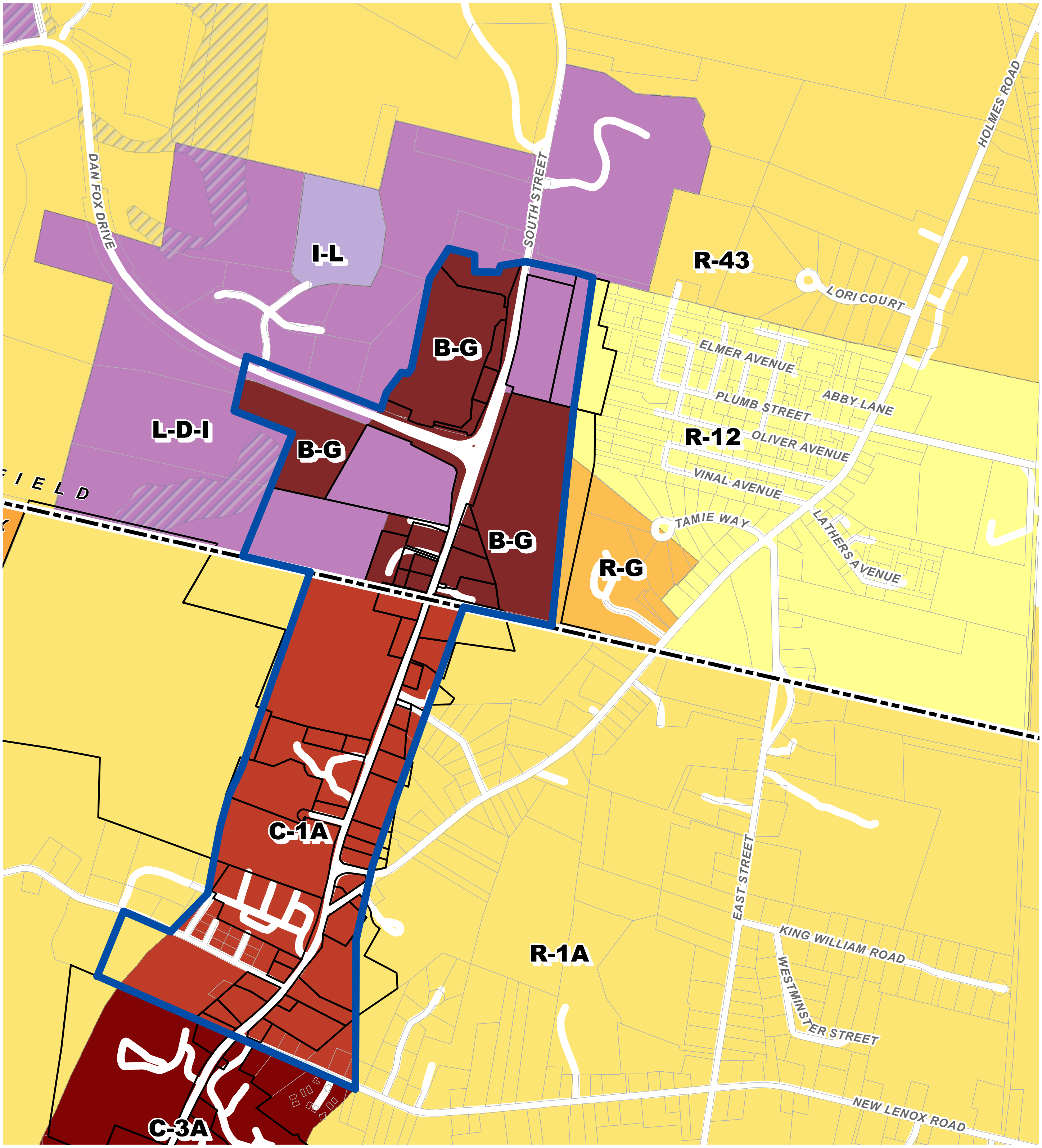
- *Setbacks:* identifies dimensional requirements and allowed structures and improvements within the setback;
- *Parking:* identifies the required parking for the underlying zoning and creates opportunities for shared parking between two adjacent parcels;
- *Driveway Design:* sets standards for closing, relocating, or redesigning access points;
- *Cross Access:* applies cross access and shared driveway requirements when current access does not comply with the driveway spacing standards and to minimize the number of driveways ;
- *Drive-Through Uses:* identifies requirements that a drive-through establishment would need to meet; and
- *Landscaping:* identifies landscaping requirements for different size developments and includes front yard, interior and perimeter standards.

The following matrix has been prepared to summarize and compare the existing zoning requirements for the Town of Lenox and the City of Pittsfield to the proposed zoning requirements for the new zoning bylaw, and Figure 7-10 illustrates the proposed zoning boundary as compared to the current zoning for the corridor.

Table 7-4
Zoning Comparison Matrix

	Existing Zoning			New Bylaw
Design Standards	*Town of Lenox C-1A Commercial*	*City of Pittsfield: General Business*		*New Zoning By Law*
Minimum Frontage	200’	NA		200’
Height Limitation	35’	50’		35’
Setbacks				
Street Line	50’	NA		50’
Lot Line	30’	NA		30’
Sign	35’	NA		15’
Parking	30’	NA		30’
Parking Requirements	Varies by use	Varies by use		Varies by use
Driveway Spacing		Only state standards for Dan Fox Corridor District		
Same Side of Street	No	No[11]		300’ for 40mph
Opposite side of street	No	No		530’ for 40mph
Cross Access Driveway	No	No		Yes
Drive-Through Requirements	Yes – special permit required	Yes – special permit required		Yes
Landscaping Requirements	Mostly as it relates to parking lots	General, mostly for screening; also in SGOD 40R design guidelines		Yes

[11] Some special permit uses have spacing standards for driveways and adjacent lot lines.



Source: Mass GIS, Berkshire County, Town of Lenox, City of Pittsfield

Legend

- Town Boundaries
- Floodplain District Overlay
- Zoning Bylaw Boundary

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Limits Of Proposed Zoning Bylaw Boundary

Figure 7-10

Route 7/20 Corridor Access Management Plan

0 550 1,100 Feet

7.4 Conclusion

The Route 7/20 corridor is a highly traveled arterial roadway that serves as a major mobility corridor for the Berkshires. The study area, between New Lenox Road in Lenox and Dan Fox Drive in Pittsfield, experiences some traffic congestion during the peak hours. However, the corridor does have a significant number of curb cuts over its approximate one-mile length, and as such, there are areas where vehicle-crashes are significant and are a concern. When future development and redevelopment occurs along the corridor and in the region, traffic volumes along the corridor can be expected to increase. As traffic volumes increase, there is the potential that the two way left turn lane (TWLTL) could become ineffective, and safety will worsen. This study identified several areas along the corridor that currently have roadway, access, and pedestrian issues, and should traffic increase, these issues will continue to be a concern under future traffic conditions. As the corridor, and surrounding communities, becomes more developed, these existing issues and future concerns become more problematic.

A primary goal of this study was targeted at developing an action plan to help preserve the capacity and mobility of the corridor. As such, this study should act as a guideline for the Study Management Committee and other stakeholders of the corridor to apply the action plan that has been identified to preserve the mobility and safety of the corridor.

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Glossary

Abutter - Owner of a contiguous property

Access Control - Full Control - Priority given to through traffic by providing access only at grade-separated interchanges with selected public roads; no at-grade crossings or private driveway connections are allowed; freeway is the common term used for this type of highway

Access Control - Partial Control - An intermediate level between full control of access and regulatory restriction; priority given to through traffic, but a few at-grade intersections and private driveway connections may be allowed; may be provided for certain rural arterials

Access Control - Statute, Zoning, Regulation - Zoning may be used to effectively control the adjacent property development so that major generators of traffic will not develop; driveway regulations and permits are used to control the geometric design of an entrance, driveway spacing, and driveway proximity to public road intersections

Access Control - Tool used to maintain safe and efficient roadway operations; exercised by statute, zoning, right-of-way purchases, driveway controls, turning and parking regulations, and geometric design

Access Management - Broad set of techniques that balance the need to provide efficient, safe and timely travel with the ability to allow access to an individual destination

Access, Controlled - Access control applied to freeways or other major arterials where access to the roadway is limited to interchange points or major intersections

Access, Full - Access control applied to arterials or collectors where access is provided to adjoining properties without restrictions on turning movements

Access, Limited - Access control applied to arterials where intersections are widely spaced and driveway connections are limited

Access, Uncontrolled - Refers to collectors and local roads where access controls are not employed

Accommodation - Provision of safe, convenient, and comfortable travel roadway users

Actuation - Used to describe a signal that operates based on detecting vehicles to determine the need for and the length of signal phases

Alignment, Horizontal - Horizontal location of a road

Alignment, Vertical - Vertical location of a road

Alteration - Modification made to an existing facility that goes beyond normal maintenance activities and affects or could affect usability

Alternatives Analysis - Analysis of project alternatives, selected from those advocated by interested groups or recommended by local or State government; could include various transportation facility types for all modes of transportation (pedestrian, bicycle, motorist, or transit) and range of management strategies

American Association of State Highway and Transportation Officials (AASHTO) – A nonprofit, nonpartisan association representing highway and transportation departments in the 50 states, the District of Columbia and Puerto Rico. It represents all five transportation modes: air, highways, public transportation, rail, and water. Its primary goal is to foster the development, operation, and maintenance of an integrated national transportation system. Advocates transportation policies, provides technical services, and facilitates as-needed institutional changes in areas impacting transportation facilities and policies.

Americans with Disabilities Act (ADA) - Federal regulations that provide Standards for Accessible Design

Americans With Disabilities Act Architectural Design Standards (ADAAG) - Requirements for accessibility to buildings and facilities by individuals with disabilities under the Americans with Disabilities Act (ADA) of 1990

Angle of Intersection - Angle formed by the centerlines of intersecting streets, at the center of their jointly used pavement

Approach Leg - Side of an intersection leg used by traffic approaching an intersection

Architectural Access Board (AAB) - Regulatory agency within the Massachusetts Executive Office of Public Safety with a legislative mandate to develop and enforce regulations designed to make public buildings accessible to, functional for, and safe for use by persons with disabilities

Arterial - A signalized street that primarily serves through-traffic and that secondarily provides access to abutting properties, with signal spacing of 2.0 miles or less

Automatic Traffic Recorder (ATR) - Recorder which provides continuous traffic monitoring and collects traffic data for analysis, including volume, speed, classification, and gaps

Auxiliary Lane - Portion of the roadway adjoining the traveled way for speed change, turning, storage for turning, weaving, truck climbing, and other purposes supplementary to through-traffic movement

Average Annual Daily Traffic (AADT) - The total volume of traffic passing a point of segment of a highway facility in both directions for one year divided by the number of days in the year.

Average Daily Traffic (ADT) - The total traffic volume during a given period (from 1 to 364 days) divided by the number of days in that period. Current ADT volumes can be determined by continuous traffic counts or periodic counts. Where only periodic traffic counts are taken, ADT volume can be established by applying correction factors such as for season or day of week. For roadways having traffic in two directions, the ADT includes traffic in both directions unless specified otherwise.

Back of Queue - The distance between the stop line of a signalized intersection and the farthest reach of an upstream queue, expressed as a number of vehicles. The vehicles previously stopped at the front of the queue are counted even if they begin moving.

Base Mapping – Plan or geographic information

Bituminous Concrete - Paving material composed of a petroleum derivative and crushed stone or crushed gravel

Bus Bay - Bus stop that requires buses to exit from and re-enter an adjacent lane of traffic; a pull-off

Bus Stop, Far-Side - Bus stop located immediately after passing through an intersection

Bus Stop, Midblock - Bus stop located within the block, not necessarily associated with an intersection, and generally adjacent to major generator of transit ridership

Bus Stop, Near-Side -Bus stop located immediately prior to an intersection

Call Button - Button used to initiate a pedestrian crossing phase at traffic- actuated signals

Capacity - The maximum sustainable flow rate at which vehicles or persons reasonably can be expected to traverse a point or uniform segment of a lane or roadway during a specified time period under given conditions; usually expressed as vehicles per hour, passenger cars per hour, or persons per hour.

Clear Zone - Traversable, unobstructed roadside area beyond the edge of the traveled way, available for safe use by errant vehicles; also called a recovery area

Clearance Interval - Length of time, in seconds, of the yellow signal indication provided for vehicles to clear the intersection after the green interval.

Concurrent Pedestrian Phase - Pedestrians may cross parallel with the vehicles that have a green signal while motorists may turn left or right across pedestrians' paths after yielding to pedestrians.

Conflicting Movements - The traffic streams in conflict at an unsignalized intersection.

Congested Flow - A traffic flow condition caused by a downstream bottleneck.

Control Delay - Delay that is the result of traffic control devices needed to allocate potentially conflicting flows at an intersection; reflects the difference between travel time through the intersection at free flow versus travel time under the encountered conditions of traffic control

Corner Clearance - Distance from roadway intersections to the nearest driveway entrance

Corridor – A broad geographical band that follows a general directional flow connecting major sources of trips that may contain a number of streets, highways and transit route alignments.

Corridor Study - Study of a corridor including, social, economic, and environmental considerations, and project alternatives

Crash (Highway) – An event that produces injury and/or property damage, involves a motor vehicle in transport, and occurs on a traffic way or while the vehicle is still in motion after running off the traffic way.

Crash Data - Historical data used to identify crash patterns at an intersection.

Critical Gap - The minimum time, in seconds, between successive major-stream vehicles, in which a minor-street vehicle can make a maneuver.

Critical Volume-to-Capacity Ratio - The proportion of available intersection capacity used by vehicles in critical lane groups

Cross Section - View of a vertical plane cutting through the roadway, laterally perpendicular to the center line, showing the relationship of various roadway components

Cross Street - The minor street in an intersection

Crosswalk, Textured - Crosswalk which uses non-slip bricks or pavers to raise a driver's awareness through increased noise and vibrations; colored pavers, which increase the visibility of the intersection, may also be used

Cultural Resources - Sites, structures, landscapes, and objects of importance to a culture or community for social scientific, traditional, religious, or other reasons

Curb – A raised device used extensively on urban streets and highways, controls drainage, restricts vehicles to the pavement area and defines points of access to abutting properties

Curb Extension - Extension of curb which shortens the crossing distance, provides additional space at the corner (simplifying the placement of elements like curb ramps), and allow pedestrians to see and be seen before entering the crosswalk; sometimes called curb bulbs or bulb-outs

Curve Radius – Distance from a point on a highway curve to the center of a circle formed by that curve

Cycle - The time it takes for a signalized intersection to complete all phases of vehicle and pedestrian movements.

Cycle Length - The total time for a signal to complete one cycle.

Delay - The additional travel time experienced by a driver, passenger, or pedestrian from not operating in a free-flow manner.

Demand - The number of users desiring service on the highway system, usually expressed as vehicles per hour or passenger cars per hour.

Density – (1) Amount of development per acre on a parcel either existing or permitted under the zoning law, **or** (2) The number of vehicles in a given length of roadway, which is usually expressed in vehicles/mile, or (3) The number of access points or driveways in a given length of roadway, which is usually expressed in driveways/mile.

Departure Leg - Side of an intersection leg used by traffic leaving an intersection

Design Speed - Selected speed used to determine the various design features of the roadway.

Design Vehicle - Type and size of vehicle expected to be regularly accommodated on a roadway

Design Volume - A volume determined for use in design, representing traffic expected to use the highway 10 to 20 years in the future; unless otherwise stated, it is an hourly volume

Detection - Devices that sense the presence of vehicles or pedestrians; examples include magnetic signal loops embedded in the pavement and pedestrian call buttons.

Diverge - Occurs when a vehicle in the traffic stream leaves the traffic stream, such as vehicles exiting a freeway.

Divided Highway - Highway with separated roadways for traffic in opposite directions

Downstream - The direction *to* which traffic is flowing.

Driveway Closure - Method of eliminating conflicts with an arterial, elimination of a driveway

Driveway -Point of access from a public street to private property

Effective Green Time - The time during which a given traffic movement or set of movements may proceed; it is equal to the cycle length minus the effective red time

Estimate - Documentation prepared for project budgeting and to evaluate responses to project advertisements

Estimate, Contract - Estimate for the project showing the total project cost, including total contract items, construction engineering, contingencies, force counts, non-participating costs, and a summary of project costs which include the requested federal funds

Exclusive Pedestrian Interval - Stops traffic in all directions, eliminating pedestrian conflicts with turning vehicles; most applicable to downtown areas with high pedestrian volumes (e.g., more than 1,200 pedestrian crossings per day); also called scramble timing

Exclusive Pedestrian Phase - Vehicular traffic is stopped in all directions and pedestrians are allowed to cross in all directions.

Executive Office of Environmental Affairs (EOEA) - Massachusetts agency whose overall mission is to safeguard public health from environmental threats and to preserve, protect, and enhance the natural resources of the Commonwealth.

Executive Office of Transportation (EOT) - Massachusetts agency whose goal is to promote economic vitality and a better quality of life by efficiently moving people and goods within and through the Commonwealth.

Fatality – For purposes of statistical reporting on transportation safety, a fatality is considered a death due to injuries in a transportation crash, accident, or incident that occurs within 30 days of that occurrence.

Federal Highway Administration (FHWA) – A branch of the U.S. Department of Transportation that administers the federal-aid Highway Program, providing financial assistance to states to construct and improve highways, urban and rural roads, and bridges. The FHWA also administers the Federal Lands Highway Program, including survey, design, and construction of forest highway system roads, parkways and park roads, Indian reservation roads, defense access roads, and other federal lands roads. The federal agency within the U.S. Department of Transportation responsible for administering the Federal-Aid Highway Program. Became a component of the Department of Transportation in 1967 pursuant to the Department of Transportation Act (49 U.S.C. app. 1651 note). It administers the highway transportation programs of the Department of Transportation under pertinent legislation.

Flow - Measurement of the number of pedestrians, bicycles, and/or motor vehicles moving through a transportation network; quality of flow is stated as "level of service" and maximum flow is stated as "capacity"

Flow, Interrupted - Flow in which vehicles on facilities are influenced by external factors, such as traffic signals, stop or yield signs, or frequent uncontrolled intersections or high-volume driveways.

Flow, Non-Uniform - When the depth of flow changes along the length of the open channel

Flow, Steady - When the quantity of water passing any section is constant with time; at any point, the rates of inflow and outflow must be constant and equal

Flow, Uniform - Flow which results from a constant channel cross section, grade, and roughness; depth, slope, and velocity will remain constant over a given length of channel; the slopes of the channel bottom, hydraulic gradient, and energy gradient are equal

Flow, Uninterrupted - Flow in which vehicles are not interrupted by external factors; occurs on freeways and some rural roads.

Flow, Unsteady - When there are variations in the discharge with time

Freeway - A divided highway facility having two or more lanes for the exclusive use of traffic in each direction and full control of access (very high mobility, limited access).

Frontage Road - An arterial type roadway that parallels a major transportation facility such as a freeway. It serves to collect and distribute traffic along the major facility without impeding flow along the freeway. Frontage roads are also referred to by the public as "access," "feeder," and "service" roads.

Functional Classification - Classification of roadway types based on the degree of access and mobility provided

Gap - The time between passing vehicles. Pedestrian crossing opportunities can be measured in gaps, as well as opportunities for vehicles to enter a roadway from a side street.

Gap Acceptance - The process by which a minor street vehicle accepts an available gap to safely execute a maneuver.

Gap Study - Data collected in peak hours, measuring the successive gaps, measured in seconds, passing a side street.

Gateway - Street-side feature, located close to the pavement edge, which appears to narrow the road and therefore reduce the operating speed of approaching motorists

Geographic Information System (GIS) – 1) Computerized data management system designed to capture, store, retrieve, analyze, and display geographically referenced information. 2) A system of hardware, software, and data for collecting, storing, analyzing, and disseminating information about areas of the Earth. For Highway Performance Monitoring System (HPMS) purposes, GIS is defined as a highway network (spatial data which graphically represents the geometry of the highways, an electronic map) and its geographically referenced component attributes (HPMS section data, bridge data, and other data including socioeconomic data) that are integrated through GIS technology to perform analyses. From this, GIS can display attributes and analyze results electronically in map form.

Geometric Improvements - Improvements which focus on increasing intersection capacity and enhancing safety; often involve widening to provide auxiliary turn lanes and the installation or modification of traffic signals

Gore - Area where a ramp diverges from the mainline; normally considered to be both the paved triangular area between the through lane and the exit lane and the unpaved graded area which extends downstream beyond the gore nose

Grade - Slope of roadway surface typically given in percent. For example, a two-percent grade represents two feet of elevation change over a 100-foot distance.

Green Time - The duration, in seconds, of the green indication for a given movement of a signalized intersection.

Headway - Space or time between two consecutive repetitive actions (e.g., frequency of transit vehicles, time between subsequent cars passing through an intersection).

Heavy Vehicle - A vehicle with more than four wheels touching the pavement during normal operation

Heavy Vehicle Percent (HV%) - Percentage of vehicles on a roadway that are characterized as heavy vehicles

Highway – Any road, street, parkway, or freeway/expressway that includes rights-of-way, bridges, railroad-highway crossings, tunnels, drainage structures, signs, guardrail, and protective structures in connection with highways. The highway further includes that portion of any interstate or international bridge or tunnel and the approaches thereto (23 U.S.C. 101a).

Highway Capacity Manual (HCM) - Industry standard that defines transportation-facility capacity and how to evaluate it; based on Circular 212.

Highway Capacity Software (HCS) - Computer software designed to replicate procedures, manual worksheets, and examples in the Highway Capacity Manual (HCM) which is issued by the Transportation Research Board. The HCM covers topics including: freeways, freeway weaves and ramps; multilane and two-lane highways; and, urban roadways including signalized and unsignalized intersections, arterials, transit, pedestrians, and bicycles.

Highway Corridor Overlay District (HCOD) - Set of zoning regulations for parcels within a certain distance from a roadway, usually an arterial highway, which govern access, visibility, and corridor aesthetics

Horizontal Curve - Bend from a straight line along a roadway

Hourly Volume (HV) - The volume of traffic (given in units of vehicle per hour) that traverses across a segment of a roadway in one hour. The HV may be determined from traffic counts or may be a projected calculation; refer to Design Hour Volume.

Impact - Effect of any direct man-made actions or indirect repercussions of man-made actions on existing physical, environmental, social, or economic conditions

Improvement Concept – General term that refers to conceptual-level solutions to address the transportation deficiencies identified in the purpose and need statement.

Infrastructure - Basic facilities, services, and installations needed for the functioning of a community or society, including water and sewage systems, lighting, drainage, parks, public buildings, roads and transportation facilities, and utilities

Institute of Transportation Engineers (ITE) - International Educational and Scientific Association of transportation and traffic engineers; facilitate the application of technology and scientific principles research, planning and design.

Inter-Parcel Connections – Sometimes called cross access, cross driveways, or cross sidewalks, Inter-Parcel Connections connect commercial sites so that traffic moving from one to the other need not access the public street**.**

Intersection - Area where two or more streets cross at grade, including areas needed for all modes of travel (pedestrian, bicycle, motor vehicle, transit)

Intersection Alignment - Alignment which controls the centerlines of both the main and cross streets, in turn establishing the location of all other intersection elements (for example, edge of pavement, pavement elevation, and curb elevation)

Intersection Leg - Segment of roadway adjacent to an intersection

Intersection Sight Triangle - Triangular-shaped zone, sufficiently clear of visual obstructions to permit drivers entering the intersection to approach and negotiate it safely.

Intersection Spacing - Spacing of intersections, particularly for urban streets, to minimize the possibility of conflicts in traffic operations between adjacent intersections

Intersection, Channelized - Intersection which uses raised islands to designate the intended vehicle path

Intersection, Multi-Leg - Intersection with five or six legs

Island, Refuge - Pedestrian refuge within the right-of-way and traffic lanes of a highway or street; also used as loading stops for light rail or buses

K-Factor - Percent of daily traffic that occurs during the peak hour; also known as design hour factor; PH = (ADT)*(K).

Lag Vehicle Interval – A phase of a traffic signal where one approach of the intersection is allowed to continue to move after the other approach has stopped.

Land Use - Occupation or utilization of land or water area for any human activity purpose, typically classified under a system which designates the appropriate uses of particular properties

Land Use Plan – A plan which establishes strategies for the use of land to meet identified community needs.

Leading Pedestrian Interval - Advance walk signal for pedestrians before motorists get a green signal, giving the pedestrian several seconds to start in the crosswalk where there are vehicular turning movements across the crosswalk.

Lead Vehicle Interval – A phase of a traffic signal where one approach of the intersection is allowed to move before any other approach.

Left-Turn Lane - Lane which removes stopped or slow-moving left-turning vehicle from the stream of through traffic.

Level of Service (LOS) – The concept of level of service uses qualitative measures that characterize operational conditions within a traffic stream and their perception by motorists and passengers. The descriptions of individual levels of service characterize these conditions in terms of such factors as speed and travel time, freedom to maneuver, traffic interruptions, and comfort and convenience. Six levels of service are defined, designated A through F, with A representing the best conditions and F the worst.

Major Arterial - Roadway that services statewide travel as well as major traffic movements within urbanized areas or between suburban centers (high mobility, limited access).

Major Collector - Roadway that links arterial roadways and provides connections between cities and towns (moderate mobility, moderate access).

Manual on Uniform Traffic Control Devices (MUTCD) - Approved by the Federal Highway Administrator as the national standard governing traffic control devices deployed on United States roadway system.

Massachusetts Environmental Policy Act (MEPA) - As part of the EOEA, the MEPA office requires that state agencies study the environmental consequences of their actions, including permitting and financial assistance. It also requires the agencies to take all feasible measures to avoid, minimize, and mitigate damage to the environment.

Massachusetts Department of Transportation (MassDOT) - As part of the EOT, MassDOT's responsibilities are the design, construction, and maintenance of the Commonwealth's highways and bridges.

Measures of Effectiveness (MOE) - MOE provide insight into the effects on the traffic stream of the applied improvement strategy. MOE include: average vehicle speed, vehicle stops, delays, vehicle-hours of travel, vehicle-miles of travel, fuel consumption and pollutant emissions.

Median - Portion of a roadway separating opposing directions of the traveled way, with purpose and design varying depending on roadway type may be traversable or nontraversable

Merge - Occurs when a vehicle in one traffic stream joins another traffic stream moving in the same direction without the aid of traffic signals or other right-of-way controls, such as vehicles entering a freeway.

Minor Arterial - Roadway that links cities and towns in rural areas and interconnects major arterials within urban areas (moderate mobility, limited access).

Minor Collector - Roadway that connects local roads to major collectors and arterials (moderate mobility, high access).

Mobility - Ability to move or be moved from place to place

Mode - Particular means of transportation (e.g., transit, automobile, bicycle, walking).

Mode choice - The process by which an individual selects a transport mode for use on a trip based on trip purpose, trip location, characteristics of the individual, and characteristics of the available modes.

Mode split - The number (or percentage) of trips between zones that are made by automobile and by transit respectively.

Multi-modal - Serving multiple user groups, including motor vehicles, pedestrians, bicyclists, and transit vehicles.

National Cooperative Highway Research Program (NCHRP) - Administered by the Transportation Research Board (TRB) and sponsored by the member departments of AASHTO, in cooperation with the FHWA, created in 1962 as a means to conduct research in acute problem areas that affect highway planning, design, construction, operation, and maintenance nationwide.

National Highway System (NHS) - One of the three major components of the 1991 Intermodal Surface Transportation Efficiency Act. A major new Federal-aid system was established in the NHS. It includes the Interstate System, other routes identified as having strategic defense characteristics, routes providing access to major ports, airports, public transportation and intermodal transportation facilities and, of particular significance to local governments, and many principal urban and rural arterials which provide regional service.

Non-Traversable Median - Median which separates opposing traffic

Notice of Intent (NOI) - A notice that is prepared to inform the public that an Environmental Impact Statement will be prepared for a project

Offset - The time difference in the beginning of green between coordinated traffic control signals, expressed in seconds.

Operating Speed - A speed measurement that reflects the majority of motorists

Overlap - Green indication that allows traffic movement during the green intervals of and clearance intervals between two or more phases; for example, right turns are protected on a compatible left-turn phase.

Pass-by Trips - Trips made as intermediate stops by vehicles on the way from an origin to a primary trip destination, without a route diversion. Pass-by trips are attracted to a use from the existing adjacent street traffic flow and therefore do not add new traffic to the roadway system.

Passenger Car – A motor vehicle designed primarily for carrying passengers on ordinary roads, includes convertibles, sedans, and station wagons.

Path Crossing, Mid-Block - Path which crosses a street at a location other than an intersection

Peak Hour Factor (PHF) – PHF represents the flow variation within an hour and is a ratio of the total hourly traffic volume to the maximum 15-minute traffic rate within the hour (PHF = Hourly Volume/(4 * Peak 15 Min. Volume)). The calculated value is always between 0.25 and 1.00; the closer to 1.00, the more uniform the flow is over each 15-minute period.

Peak Period - The time(s) of day when the highest volume of vehicles, pedestrians, and/or cyclists are typically encountered on a roadway.

Peak-Hour Traffic (PH) - Highest number of vehicles passing over a section of highway during 60 consecutive minutes; T (PH) is the PH for truck traffic only

Pedestrian Count/Demand – Data collection to determine sidewalk demands, crossing demands, and corner reservoir demands (total number of pedestrians waiting to cross the street); usually conducted when vehicle turning movement counts are completed

Perception-Reaction Time - The time required for a driver or pedestrian to evaluate and react to a stimulus. The process can be broken down into four sub-processes: perception, identification, emotion, and volition (or reaction); also referred to as **PIEV time**.

Permissive Phase – A phase of a traffic signal where vehicles are allowed (or permitted) to turn while other signal phases are on-going; these vehicles would yield to any vehicle traveling in the opposite direction. (See **Permitted Turn**)

Permitted Turn - Left or right turn at a signalized intersection that is made against an opposing or conflicting vehicular or pedestrian flow

Planning - Phase of the project in which the proponent identifies issues, impacts, and potential approvals so that subsequent design and permitting processes are understood

Platoon - Group or 'slug' of traffic, often created by the regular release of traffic from an upstream or downstream traffic signal.

Pre-timed Signal - Used to describe a signal that operates based on a fixed set of signal phases to direct traffic through the intersection.

Protected Phase – A phase of a traffic signal where turning movements are allowed or permitted to complete their movement while other phases are on-going. Vehicles would yield to any vehicle traveling in the opposite direction. (See **Protected Turn**)

Professional Engineer (PE) - Registered or licensed engineers in some countries, including the United States and Canada. In the United States, registration or licensure of Professional Engineers is performed by the individual states. Each registration or license is valid only in the state in which it is granted.

Professional Traffic Operations Engineer (PTOE) - Certification requires that the holder be a licensed professional engineer if he or she practices in the United States, Canada or any other country that provides governmental licensing of engineers. This certification process builds on and supports the practice of professional engineering registration.

Progression - The manner in which a traffic stream advances through a defined corridor.

Proponent - Individual or organization that proposes, prepares, manages, and implements a project.

Protected Plus Permitted - Compound left-turn protection at a signalized intersection that displays the protected phase before the permitted phase (see **Permitted Turn** and **Protected Turn**).

Protected Turn - The left or right turns at a signalized intersection that are made with no opposing or conflicting vehicular or pedestrian movement.

Public Hearing - Legally recognized formal meeting held at particular time(s) during the project development and design phases

Public Meeting - Informal gathering of designers, officials, and local citizens to share and discuss proposed actions; a forum for public participation in a project.

Public Road – Any road under the jurisdiction of and maintained by a public authority (federal, state, county, town or township, local government, or instrumentality thereof) and open to public travel.

Queue - Occurs when arriving vehicles or people at a service area wait for service; this service may be the appearance of an acceptable gap in the main traffic stream, the collection of tolls at a toll booth, etc.

Right Of Way (ROW) - The land (usually a strip) acquired for or devoted to transportation purposes. For example, highway ROW and railroad ROW.

Right Turn on Red (RTOR) – The permission of stopped vehicles on an approach to turn right on a red ball indication to join the moving stream of traffic. A permissible right turn on red (RTOR) was introduced in the 1970s as a fuel-saving measure.

Right-Turn Lane - Lane which removes decelerating right-turning vehicles from the traffic stream.

Road – An open way for the passage of vehicles, persons, or animals on land.

Roadway Alignment - The vertical and horizontal location of a road

Roadway Landscape - Interface between the functional area of a road and the community or environment through which it passes

Roundabout - Channelized intersection that creates a one-way traffic stream circulating around a central island in which all entering vehicles must yield to the circulating traffic.

Rumble Strip - Strip of painted, ridged, or grooved road surface to warn drivers when they stray from their lanes onto the shoulder

Rural - Refers to areas with large expanses of undeveloped or agricultural land, dotted by small towns, villages, or any other small activity clusters

Sag Vertical Curve - Curve that connects descending grades, forming a bowl or a sag

Seasonal Adjustment - Adjustments based on historical observations made to collected data to represent average/representative conditions in a given area.

Service Flow Rate - The maximum hourly rate at which vehicles, bicycles, or persons can be expected to traverse a point or uniform segment of a lane or roadway during a given time period under prevailing conditions while maintaining a designated level of service; expressed as vehicles per hour or vehicles per hour per lane.

Shared Lane - Vehicular travel lane shared by pedestrians, particularly on low-traffic and low-speed roadways

Shared Street - Street designed to be fully part of the public realm and integrated into the surrounding context; examples include plazas in a town center, market places with street vending, streets regularly used for festivals, and places of unusual civic interest

Shared Use Path - Facility for non-motorized users that is independently aligned and not necessarily associated with parallel roadways; designed to accommodate a variety of users, including walkers, bicyclists, joggers, people with disabilities, skaters, pets and sometimes equestrians

Shoulder - Portion of a roadway adjacent to a traveled way for accommodation of stopped vehicles, for emergency use, and for lateral support of the base and surface courses.

Sidewalk - Path for pedestrian travel which follows a street and occupies the border between the vehicular travel ways and private property.

Sight Distance - Line of sight available to the driver to see another roadway user or a fixed object.

Sight Distance, Intersection (ISD) - For a two-lane highway, the operator of a vehicle approaching an intersection should have an unobstructed view of the entire intersection, including any traffic control devices, and an adequate view of the intersecting highway to anticipate and avoid potential collisions.

Sight Distance, Stopping (SSD) - Absolute minimum sight distance that should be provided at any point on the highway; the sum of two distances: (1) the distance traveled during driver perception/reaction time; and (2) the distance traveled during brake application.

Signal Coordination - Method of establishing relationships between adjacent traffic control signals using offsets. Traffic signal coordination reduces delay and unnecessary stops at traffic signals.

Signal Phase - The portion of a signal cycle that serves a combination of traffic movements.

Signal Progression - When all signals on a roadway are timed so that a vehicle leaving the first intersection will arrive at all downstream locations just as the signals at those intersections turn green. Signal progression can be in one direction or both directions along a roadway.

Signal Timing - The operational program for a traffic signal and resulting assignment of right-of-way to different users.

Signal Warrant - Criteria for installing a traffic control device. Typically, traffic signal warrants are based on pedestrian volumes, traffic volumes, and/or collisions. Set by the **MUTCD**.

Speed – (1) Design speed - the maximum safe speed that can be maintained over a specified section of highway when conditions are so favorable that the design features of the highway govern. (2) Operating speed - the speed at which drivers are observed operating their vehicles. (3) Posted speed - the maximum speed limit posted on a section of roadway using a regulatory sign. (4) "85th percentile speed" - the speed at or below which 85 percent of drivers on a given roadway are operating their vehicles. This speed is often used in many calculations, and can be considered the "prevailing speed".

Stakeholder - Individual having an interest or share in a project, or who may be impacted by the outcome of a project, either directly or indirectly

Statewide Transportation Improvement Program (STIP) - A staged, multi-year, statewide, intermodal program of transportation projects which is consistent with the Statewide Transportation Plan (STP) and planning processes and metropolitan plans, TIPs and processes. The STP is developed in cooperation with the Metropolitan Planning Organization (MPO) programs.

Station - Unit of measurement consisting of 100 feet in horizontal distance

Stop Control, Two-Way - Traffic controlled by "STOP" sign on the cross street approaches; main street traffic is not controlled.

Storage Area - Auxiliary lane approaching an intersection which stores turning vehicles expected to accumulate during an average peak period

Streetscape - The road and its surrounding built environment as a whole

Suburban - Refers to fringes of metropolitan areas that are typically lower density than cities and where land uses are widely variant

SYNCHRO - Software application for optimizing traffic signal timing and performing capacity analysis. The software optimizes splits, offsets, and cycle lengths for individual intersections, an arterial, or a complete network.

Traffic Calming - Physical road design elements intended to reduce vehicle speeds and improve driver attentiveness

Traffic control – The train signals located along the tracks and that tell the train engineer the speed limit (or confirm the speed limit listed in the timetable) at that time on the next section of track.

Traffic Control Device - Any sign, signal, or marking installed for the purpose of regulating, warning, informing, or guiding traffic.

Traffic Forecast - Technical analysis and policy consensus on future traffic volumes resulting from the type and intensity of land use, future regional economic activity, presence of transit service, the needs of pedestrian and cyclists, and many other factors

Traffic Impact and Access Study (TIAS) - Assessment of the impacts on nearby roadways of new development proposals, often resulting in commitments for access design and offsite roadway improvements

Traffic Signal - Electronic device which assigns right-of-way to both motorized and non-motorized traffic through the use of alternating visual indicators.

Transit - Public transportation, especially rail and bus services.

Transportation Improvement Program (TIP) - Five year funding program that allocates state and federal transportation funds, both highway and transit, for the region; prepared by MPOs every year.

Transportation Research Board (TRB) - As a division of the National Research Council, the TRBs mission is to promote innovation and progress in transportation through research. The Board facilitates the sharing of information on transportation practice and policy by researchers and practitioners; stimulates research and offers research management services that promote technical excellence; provides expert advice on transportation policy and programs; and disseminates research results broadly and encourages their implementation.

Travel Lane - Portion of a roadway for the movement of vehicles, exclusive of shoulders and auxiliary lanes

Travel Time - The time it takes a vehicle or person to travel the length of a corridor or study-area.

Traversable Median - Median typically built of textured or contrasting materials such as stamped concrete, bricks, pavers, or cobblestones; flush with the travel lanes but notably different in appearance and in feel to the driver; can be an effective traffic calming device

Trip Assignment - The process of allocating the specific number of new trips, by mode choice, onto the links/roadways of the transportation network.

Trip Distribution - The process by which trips generated in one zone are allocated to other zones in the study area.

Trip Generation - The process of determining the number of trips that will begin or end in each traffic zone within a study area.

Turning Movement Count (TMC) - Peak-hour data collected at an intersection via electronic counting boards.

Turning Roadway - Short segment of roadway accommodating a right turn, delineated by channelizing islands; used where right-turn volumes are very high, and where skewed intersections would otherwise create a very large pavement area.

Two-Way-Left-Turn-Lane (TWLTL) – A continuous lane located between opposing traffic streams that provides a refuge area for vehicles to complete left-turn movement from both directions.

Typical Section - Section which shows usual roadway (or bridge) cross sectional features including lane and shoulder widths; limits of surfacing; pavement structure data including sub-grade treatment type and depth, base course(s) thickness(es) and type of surfacing material; travel lane and shoulder cross slopes; side slope rates for cut and fill sections; ditch or storm sewer location and depth; typical right-of-way limits; profile grade line location; typical traffic barrier location median width and slopes; and curb location and geometry

Uniform Delay - The first term of the equation for lane group control delay, assuming uniform arrivals.

Upstream - The direction *from* which traffic is flowing.

Urban - Refers to central business districts, residential districts and open space parks typical of larger cities.

Vehicles Per Day (VPD) - This is a measure of traffic volume and is used as the unit for Average Annual Daily Traffic.

Vehicles Per Hour (VPH) - Similar to vehicles per day, but over the course of one 60-minute interval.

Vertical Curve - Parabolic curve used to provide a gradual change in grade between roadway segments with differing grades

Volume - Number of vehicles or persons that pass over a given section of a lane, roadway, or other traffic way during a time period of one hour or more; can be expressed in terms of daily traffic or annual traffic, as well as on an hourly basis

Volume-to-Capacity ratio (v/c) - The ratio of flow rate to capacity. The v/c ratio describes whether or not the physical geometry provides sufficient capacity for the subject movement. Low v/c ratios depict relatively free flow conditions. High v/c ratios depict more congested conditions.

Walking Speed - Speed at which a pedestrian passes through an intersection or along a facility

Walkway - Interior or exterior pathway with a prepared surface intended for pedestrian use, including but not limited to general pedestrian areas such as plazas, courts and crosswalks

Weaving Area - A section of a highway where two or more vehicle flows must cross each other's path along a length of the freeway. Weaving areas are usually formed when merge areas are closely followed by diverging areas.

Wetland - Land that is transitional between aquatic and terrestrial ecosystems and is covered with water for at least part of the year.

Yield Control - Traffic controlled by "YIELD" signs on the cross street approaches; main street traffic is not controlled.

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